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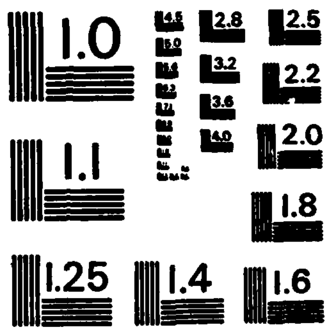

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DEFENSE COMMUNICATIONS AGENCY
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WASHINGTON, D. C. 20301

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IN REPLY REFER TO: C751

30 September 1982

TO: RECIPIENTS

SUBJECT: Change 2 to Computer System Manual CSM UM 246-82, Generalized Monitoring Facility

1. This is Change 2 to Computer System Manual CSM UM 246-82, Generalized Monitoring Facility, dated 1 May 1982. Remove obsolete pages and destroy them in accordance with applicable security regulations and insert new pages as indicated below:

Remove Pages	Insert New Pages
v	v
vi	v.1
vii	vi
ix	vi.1
x	vii
xx	vii.1
1-1 and 1-2	ix
2-1 and 2-2	x
2-5 and 2-6	xx
2-7 and 2-8	xx.1
2-9 and 2-10	1-1 and 1-2
3-3 and 3-4	2-1 and 2-2
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5-49 and 5-49.1	5-27 and 5-27.1
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5-53 and 5-54	5-27.4 and 5-27.5

Remove Pages (contd.)

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	7-3 and 7-4
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	15-1 and 15-2

2. The effective date of these change pages is 15 September 1982.

3. When this change has been made, post an entry in the Record of Changes and file this letter before the title page.

FOR THE DIRECTOR:

90 Enclosures

J. DOUGLAS POTTER
Assistant to the Director
for Administration

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SECTION 1. GENERAL

1.1 Purpose of the Users Manual

The Users Manual describes each of the programs in the Generalized Monitoring Facility (GMF), discusses input options required to run each program, and provides sample outputs generated by each program.

The Generalized Monitoring Facility is delivered on a FILSYS SAVE tape. A description of the software is presented in section 2. Installation procedures for the GMF Monitor and guidance on how to run GMF can be found in section 5 of this manual.

1.2 Project References

The Generalized Monitoring Facility was originally developed for the Government by Honeywell Information Systems. Since delivery of the completed software in 1975, the Computer Performance Evaluation Branch (C751) of the Command and Control Technical Center has extensively modified and rewritten the GMF system. Numerous software errors have been corrected and many new features have been added.

1.3 Terms and Abbreviations

The following abbreviations will be used throughout the document.

- CAM - Communications Analysis Monitor
- CM - Channel Monitor
- CPU - Central Processing Unit
- CPUM - CPU Monitor
- GCOS - Generalized Comprehensive Operating System
- GMC - Generalized Monitoring Collector
- GMF - Generalized Monitoring Facility
- GRTS - General Remote Terminal Supervisor
- GRTM - GRTS Monitor
- IDLEM - Idle Monitor

MSM	-	Mass Storage Monitor
MUM	-	Memory Utilization Monitor
RMC	-	Resource Monitor Collector
RMDRx	-	Resource Monitor Data Reduction Program 1 through 3
RMON	-	Resource Monitor
TM	-	Tape Monitor
TPEM	-	Transaction Processing Executive Monitor
TSSM	-	Timesharing Subsystem Monitor
WWMCCS	-	World Wide Military Command and Control System

1.4 Security and Privacy

There are no classified data collected in the GMF, but there is one exception. If the Communications Analysis Monitor (CAM) is being run with the Specific Terminal Option, classified data may be collected.

1.5 Manual Format

Section 2 of this Manual provides an overview of the GMF system. A brief description of each program is included. Sections 3 through 12 and 15 (not yet published) describe the programs of the GMF system in detail. In the presentation the user will find the appropriate information to successfully operate each program. The format of the sections includes a discussion of each program in the input, processing, and output phases. Section 13 of the document describes the procedures that a user should follow if it is desired to create a new GMF monitor and section 14 provides detailed information as to how GMF should be used in conducting a complete system-wide evaluation.

SECTION 2. SYSTEM SUMMARY

2.1 System Application

This section explains the GMF system by logically grouping the programs into two subsystems, the General Monitor Collector (GMC) subsystem and the Resource Monitor Collector (RMC) subsystem. Overviews of the programs in both subsystems are provided. The purpose of the GMC subsystem is to provide a means of collecting detailed information on the operation of the operating system and on the flow of a job through the system. The purpose of the RMC subsystem is to provide a general view of the operation of the system. The RMC can be run on a daily basis to allow the continuous analysis of the system operation. When it appears a problem is occurring, the GMC can be run to further define and resolve the problem area.

2.2 System Operation

Both GMC and RMC monitor GCOS in real time and generate output tapes. These output tapes are then processed through a series of data reduction routines which produce histograms, graphs, and reports which allow an analyst to evaluate system performance. Both RMC and GMC have exclusive data reduction routines (i.e., a tape generated by RMC cannot be reduced by the GMC data reduction program). Differences between the GMC and RMC subsystems pertain to the methods used to collect measurement data.

The RMC is a sampling-based monitor. At 30-second intervals, the RMC enters execution and collects its data. Since it samples only at preselected intervals, it cannot present a complete history of what has occurred on the system. However, because the RMC is a sampling-based monitor, overhead is low.

The GMC is a trace-based monitor. The various monitors that are comprised in the GMC subsystem are called into execution by the occurrences of the events that are to be captured. The GMC can therefore be used to provide a complete and detailed history of system performances.

Because all occurrences of a given event are retrieved, GMC overhead is higher than RMC. Unlike the RMC, GMC must be locked into core.

2.2.1 The Resource Monitor Collection (RMC) Subsystem. The RMC subsystem is composed of a data collector, RMC, and three associated data reduction routines. The RMC is explained in section 3, and the RMC data reduction routines are discussed in section 4.

The RMC is a sampling-based monitor. The RMC will sample system queues and tables on a 30-second time interval. The data captured from these queues and cells are written to the system accounting file.

The output generated by the RMC is input to a series of three data reduction routines. Sample report output from these data reduction routines can be found in subsection 4.3. See figure 2-1 for the RMC system flowchart and figure 2-2 for the subroutines that comprise the RMC system.

2.2.2 The Generalized Monitor (GMC) Subsystem. The GMC subsystem is composed of a series of data collector programs and a related set of data reduction programs. Each data collector program consists of one or more subroutines, and each program is used to monitor a different area of system performance. The name of the program indicates the area of system performance measured. In addition, any combination of monitoring programs may be executed during a monitor session. A detailed description of the entire data collector facility is given in section 5. Figure 2-3 shows the interrelation of all programs within the GMC subsystem. Figure 2-4 shows the subroutines that comprise each data collector program and those trace types which need to be active for each subroutine.

The mechanism used by the GMC data collector for obtaining control from the operating system is that of the normal system trace. The trace records a history of the occurrence of one or more of 72 systems events, 65 of which are presently defined. This recording is done by the system executing a unique code set resident in the System Dispatcher Module (.MDISP). Execution of this code is common to all system trace events and provides the point at which the GMC obtains control. See section 5 for a detailed description of how GMC gains control from the system.

The executive routine of the GMC processes input cards for the data collection routines determines which areas of the system are to be monitored, performs any necessary initialization, and controls all data buffering and tape writing. A detailed description of this routine is given in section 5. The associated GMC data reduction programs are described in sections 6 through 12 and section 15.

2.3 System Configuration

The GMF is designed to be run on a HIS 6000 computer system, running with WWMCCS GCOS release 6.4 or 7.2. These releases are equivalent to the HIS commercial 2H or 4JS (any level) GCOS releases. When GMC is used on WWMCCS release 6.4, or commercial release 2H, the user must insure that the value for variable "SYS64" is changed from its current value of 0 to a value of 1. See subsection 2.6 for a complete description of all user requirements prior to using the GMC. When RMC is used on WWMCCS release 6.4, or commercial release 2H, the user must insure that the value for variable "W6.4" is changed from its current value of 0 to a value of 1. See subsection 3.3.1 for details of this requirement.

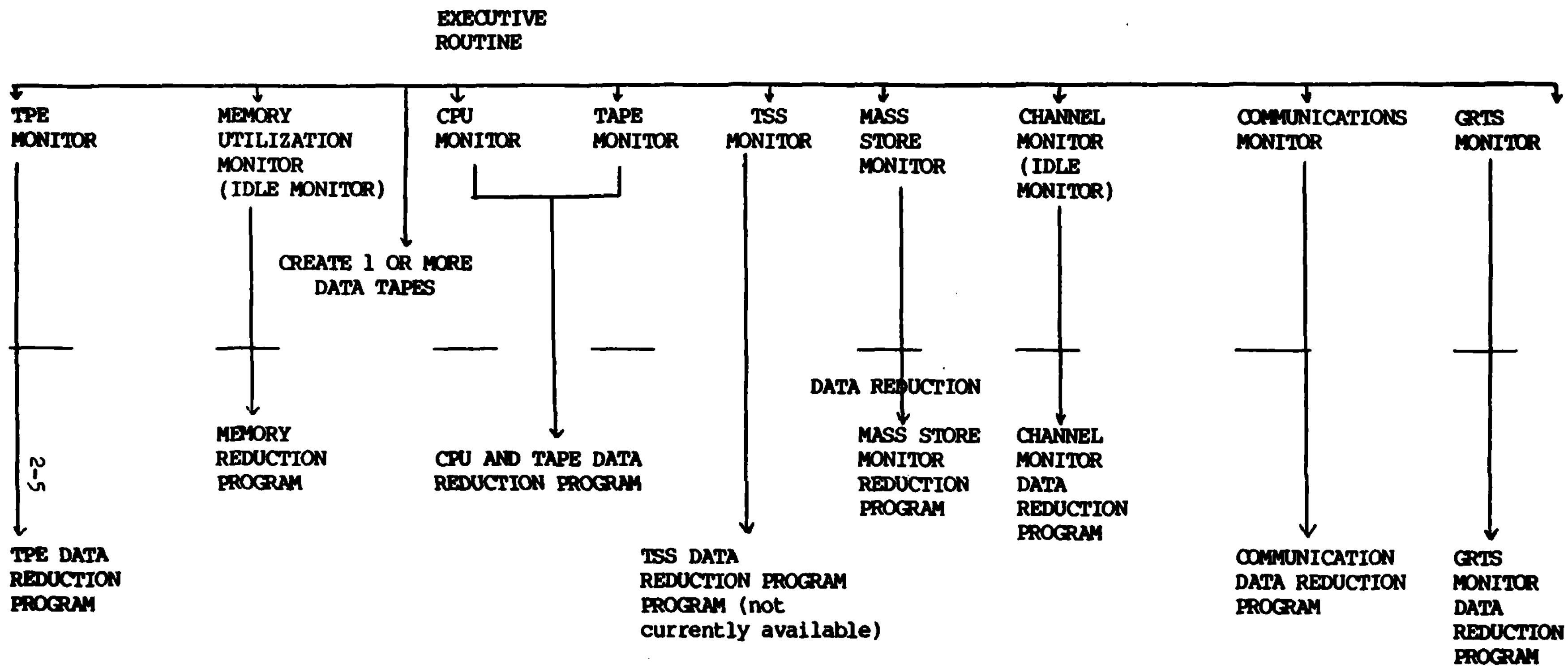

Figure 2-3. Programs in the GMC Subsystem

Data Collector Programs	Subroutines	Traces Captured
Memory Utilization Monitor	T10 T46	10,11,51 46
Idle Monitor	T21 TRCS	21 0,1,2,3,13,16,22, 37,65
Mass Store Monitor	T7	7,15,73*,76*,77*
Channel Monitor	T4,T7,T22	4,7,15,22
Tape Monitor	T50	50,51,52
CPU Monitor	T70	10,11,21,70*
Communications Analysis Monitor	T14	14*
GRTS Monitor	T62	62*
TPE Monitor	T200	0,1,2,4,5,6,13, 42,51,65,74*
TSS Monitor	T100	74*

* - Nonstandard traces generated by the particular monitor.

Figure 2-4. Subroutines and Traces in GMC Data Collector Programs

2.4 System Organization

The GMF is composed of two data collectors, GMC and RMC, and associated data reduction programs. Sections 3 through 12 describe these programs. Figure 2-1 gives a system flowchart for the RMC. Figure 5-1 gives a system flowchart for the GMC.

2.5 Performance

The GMF monitors the performance of a system, aids in identifying the start of system performance problems, and aids in analyzing system performance problems. The RMC requires very little system resource usage and writes all its data to the system accounting file. The GMC is a much more detailed system with the associated higher overhead. The GMC is used mainly to determine the cause of system performance problems. The GMC requires 15 to 24 thousand words of memory and one tape drive while being run. Both systems require offline data reduction.

2.6 GMF Installation

2.6.1 Creation of GMF Files. The GMF software is contained on a single user save tape. The USERID on the tape is B29IDPXO. This USERID must be created with 3950 LLINKS of file space. A user restore can then be run. B29IDPXO is subdivided into several catalogs described below:

- GMFCOL - 530 LLINKS - This subcatalog contains all the data collection software for the GMC monitoring system. All files within this subcatalog are completely described in section 5.

- SOURCE - 1910 LLINKS - This subcatalog contains Time Sharing source files for all data reduction programs contained within the GMC system. Figure 2-5 is a breakdown of the individual files within this subcatalog. Sections 6-12 describe each program in detail.

- OBJECT - 1105 LLINKS - This subcatalog contains the object decks for all the data reduction programs contained within the GMC system. Figure 2-5 is a breakdown of the individual files within this subcatalog.

- JCL - 14 LLINKS - This subcatalog contains all the JCL required to run all the data reduction programs contained within the GMC system. Figure 2-6 is a breakdown of the individual files within this subcatalog.

- RMON - 345 LLINKS - This subcatalog contains all the software required to collect and reduce the data for the RMON Monitoring system. This subcatalog is further subdivided into JCL, SOURCE and OBJECT subcatalogs. The files within these subcatalogs are completely described in sections 3 and 4.

FILE NAME	FUNCTION	SOURCE SIZE (LL)	OBJECT SIZE (LL)
MUM	MEMORY UTILIZATION MONITOR DATA REDUCTION PRO-. GRAM. REFERENCED IN CHAPTER 6.	365	220
MSM	MASS STORE MONITOR DATA REDUCTION PROGRAM. REFERENCED IN CHAPTER 7.	320	186
CM	CHANNEL MONITOR DATA REDUCTION PROGRAM. REFERENCED IN CHAPTER 8.	255	185
CAM	COMMUNICATION MONITOR DATA REDUCTION PROGRAM. REFERENCED IN CHAPTER 9.	185	110
CPU-TAPE	CPU AND TAPE MONITOR DATA REDUCTION PROGRAMS. REFERENCED IN CHAPTER 11.	389	152
GRT	DATANET 355 MONITOR DATA REDUCTION PROGRAM. REFERENCED IN CHAPTER 10.	280	154
TPETG	TRANSACTION PROCESSING DATA REDUCTION PROGRAM. REFERENCED IN CHAPTER 12.	64	70
TPEALT	AN ALTER FILE FOR ADDING TPE TRACE CODE INTO THE TPE SUBSYSTEM (NO OBJECT FILE). REFERENCED IN CHAPTER 12.	14	
TPEDUMP	A PROGRAM FOR OBTAINING A FORMATTED TRACE DUMP FROM A TPE/GMF DATA TAPE. REFERENCED IN CHAPTER 12.	38	26
TSS	TIMESHARING MONITOR DATA REDUCTION PROGRAM (NOT YET RELEASED). REFERENCED IN SECTION 15 (NOT YET PUBLISHED).		

Figure 2-5. B29IDPXO/SOURCE and B29IDPXO/OBJECT Catalog Structure

FILE NAME	FUNCTION	SOURCE SIZE (LL)
MUM	JCL TO OBTAIN ALL MEMORY UTILIZATION MONITOR REPORTS	2
MSM	JCL TO OBTAIN MASS STORE MONITOR REPORTS	2
CM	JCL TO OBTAIN CHANNEL MONITOR REPORTS	
CAM	JCL TO OBTAIN COMMUNI-CATION MONITOR REPORTS	2
GRT	JCL TO OBTAIN DN-355 MONITOR REPORTS	2
CPU-TAPE	JCL TO OBTAIN CPU AND TAPE MONITOR REPORTS	2
TPETG	JCL TO OBTAIN ALL REPORTS FROM THE TPE DATA REDUCTION PROGRAM	2

Figure 2-6. B29IDPX0/JCL Catalog Structure

2.6.2 GMF Release Dependent Parameters. In order for the GMC to operate properly, it is necessary for GMC to locate certain instructions and/or words within several system programs. The user should insure that these locations are correct for the particular GCOS release, under which he is operating. Table 2-1 is a list of these dependent parameters identifying their the use and providing the approximate program source line numbers where the particular parameters are used. The list is provided for each GMC program that must checked by the user.

In order to use the GMC data reduction programs on a WW6.4 system, there is a special data card required in certain programs. This option applies to all data reduction programs except CPU-TAPE and TPETG. The TPETG program is not designed for use under any release other than WW7.2. The CPU-TAPE program would require a one-line source change to be used under a WW6.4 release.

The GMC system is designed so that data collected on a WW6.4 system may be reduced under a WW6.4 system or a WW7.2 system. In addition, data collected under a WW7.2 system may likewise be reduced under a WW7.2 system, or a WW6.4 system. Whenever the data reduction programs for MUM, CM, CAM, or GRT are used on a WW6.4 system, a data card with an RN typed on it must be included in the input section of the JCL deck. It makes no difference under what release the data was collected. It is only a question of under what release the data is being reduced.

For the MSM data reduction program, there are two data cards required. The first data card always contains the letters RN. The second card is determined by the following table:

Data Collected	Data Reduced	Data Value
WW6.4	WW6.4	1
WW6.4	WW7.2	3
WW7.2	WW6.4	2
WW7.2	WW7.2	NO SPECIAL CARDS REQUIRED

For the CPU-TAPE data reduction program, it is required to delete source line #4320 and recompile when using the data reduction program under a WW6.4 release.

The RMC System is also designed to run under GCOS release WW6.4.2 (commerical release 2H), or WW7.2 (commercial release 4JS (any level)). See subsection 3.3.1 for details as to required modifications.

The RMC writes three type 609 records every 30 seconds. The type 609 record consists of one of three subtypes. These subtypes are a maximum of 210 words with the maximum size dependent upon the configured system size. The RMC initially insures that its SNUMB is RMON. This insures only one copy of RMON is running at any time. The RMC then initializes its tables according to the system configuration. Extended memory instructions are NOPed if required and any excess memory is released. The RMC then processes each of its record types every 30 seconds.

The following procedure applies to the WWMCCS software releases. The user should insure that the 600 class of SCF records have been turned on for his system. He must check two different places. First, the $SCFBUF card in the boot deck must contain at least a C6 to indicate collection of 600 level SCF records. The user should then enter the command SCFRST 609 at the system console. The system should respond with: 609/AC to indicate that the records are being collected.

The user must next insure that the system MASK cards are defined correctly. The 600 class SCF records must be turned on in INIT by use of a MASK card in the boot deck. The location to be patched with the MASK card is RMAX+6 in INIT. The location should be patched with the following octal patch

COL 1	8	13	73
OCTAL LOCATION OF RMAX+6	MASK	000012000000	.MINIT

This patch allows 10 type 600 SCF records to be collected (600-609). These same procedures should be followed by the user if he also changes the RMON SCF record number. Commercial 4Jx sites should check the System Startup Manual for procedures on defining new SCF record types.

3.3.1.1 Program Data - Subtype 1. This data type contains overhead and idle times for all configured processors, size of memory, number of processors, and number of TSS users. Each job in the system is examined and its status is saved. The subtype 1 record format is:

WORD	BITS	CONTENT
1	0-17	Size (210 words max)
	18-35	record type
2-13	0-35	Standard SCF header
14	0-17	Zero
	18-35	1 (subtype)
15	0-17	Number of TSS users
	18-35	Available memory

16-18	0-35	Not Used
19	0-35	Overhead time (.CROVH)
20	0-35	Idle time (.CRIDT)
21	0-17	Number of processors
	18-35	Configured memory (.CRMSZ)
22	0-29	SNUMB
	30-35	Reserved
23	0-17	Status from .CRSN1
	18-35	Memory size if in memory
24	0-35	Accumulated processor time

22-24 are repeated for all jobs in the system.

3.3.1.2 <u>Peripheral Data - Subtype 2.</u> This data type consists of channel use time for each channel, device status (released, assigned, dedicated, permanent, removable), and capacity of disk packs. The subtype 2 record format is:

WORD	BITS	CONTENT	
1	0-17	Size (210 words max)	
	18-35	Record	
2-13	0-35	Standard SCF header	
14	0-17	Zero	
	18-35	2 (subtype)	
15	0-17	Number of IOMs	
	18-35	Available links of mass storage	
16-18	0-35	Not used	
19	0-5	Translated device code	
	6-11	Reserved	
	12-17	Number free devices	channel/ device status counts
	18-23	Number allocated devices	
	24-29	Number dedicated devices	
	30-35	Number released devices	
20	0-35	Channel use time	

Words 19 and 20 are repeated for each channel.

SECTION 5. THE GENERAL MONITOR COLLECTOR - DATA COLLECTION PROGRAM

5.1 Introduction

The General Monitor Collector (GMC) data collection program is a privileged slave program which processes GCOS system trace data, organizes the data in GMC records, and writes the collected GMC data records on its output magnetic tape. The general concept of operation for the GMC facility is shown in figure 5-1.

As a privileged slave program, the monitor data collector requires the permission of the system operator to run and must execute in master mode. The master mode capability allows the GMC to access all of the system main memory. The areas of interest are the system Communication Region (CR) and the individual job Slave Service Areas (SSAs).

The GMC is actually a series of independent data collection monitors which are controlled via the central Executive Routine (ER) (described in subsection 5.3.1), and which use a common buffering routine for writing collected data to a common tape. The current GMC is comprised of 10 different monitors, which can be executed independently, or in any combination, except that TPE and TSS monitors cannot be run simultaneously. The monitors are described in this section. Each of the monitors has a dedicated data reduction program that produces formatted reports. These data reduction programs are described in sections 6 through 12. The TSS Data Reduction Program is currently in testing and has not been released with this release.

The GMC can obtain control from the system in one of three ways. First, the standard manner is for the GMC to obtain control via the normal system trace. Second and third, GMC may also gain control in two nonstandard manners. These are via internally created system sub-traces (referred to as IT traces) and direct transfer patches (referred to as DT traces).

In the first way, the standard mechanism used by the monitor for obtaining control from the operating system is the normal GCOS system trace. The system trace capability records a history of the occurrence of as many as 72 system events, 64 of which are presently defined. This recording takes place in a circular table in the Communication Region of memory and is accomplished by execution of a unique code set resident in the system Dispatcher Module (.MDISP). Execution of this code is common to all system trace events and provides the point at which the GMC obtains control. The initialization portion of the GMC locates the system trace code set and implants a transfer instruction to the GMC executive. Thus, whenever a system trace event occurs anywhere within the system, the GMC executive will obtain control.

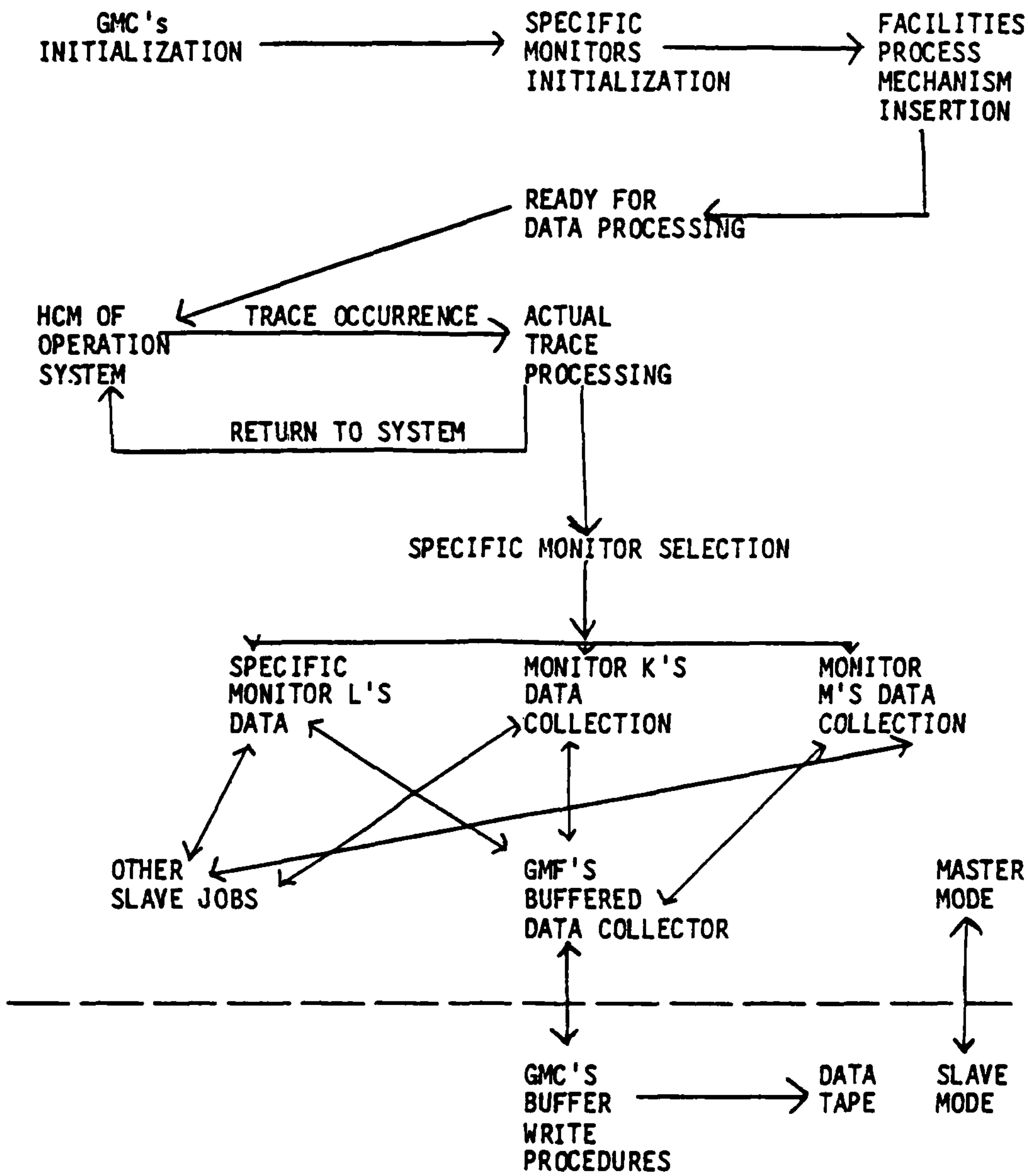

Figure 5-1. GMC Concept

After obtaining control, the system trace recording is completed using normal system procedures and then the trace is investigated. If an executing GMF monitor requires this trace type, control is given to that monitor. The monitor then collects data of interest to itself and requests the GMC executive to buffer the data. When the monitor completes its task, it returns control to the GMC executive. The GMC executive then transfers control back to the system trace processing routine within the GCOS dispatcher. The activities mentioned above take place in master mode under the guise of an extension of normal system trace procedures.

The second method used by GMC to gain control is for GMC to create its own system traces. The GMC will search a given GCOS module for a known line of code. It will replace this line of code with a transfer to a patch area. In the patch area, the monitor will insert code to create a new GMC system trace. At this point, the execution of this code will be processed just as all other system traces are processed. This procedure is used only when the Communication Analysis Monitor is selected for execution. (See subsection 5.2.6 for a complete description of this procedure.)

The third method used by GMC to gain control is via a direct transfer from a GCOS module. In this case, GMC will search a given GCOS module for a known line of code. It will replace this line of code with a direct transfer into the GMC. This can be accomplished since GMC is locked in core during its entire execution. The benefit of this procedure is that the overhead of the system trace is eliminated. This procedure is used only when the Mass Store Monitor or the CPU Monitor is selected for execution. (See subsections 5.2.2 and 5.2.3 for a complete description of this procedure.)

As the GMC ER buffers the collected monitor data, it will determine when one of the internal buffers are filled and must be written to tape. At this point, it will establish a normal slave dispatch to its tape writing facility. The tape writing facility will then write the internal buffer to tape and signal the executive that this buffer may be reused.

5.2 GMC Monitor Subroutines

In this subsection, each of the ten monitor subsystems will be addressed. Each subsystem requires that specific trace types be enabled in the H6000 system boot deck on the
$ TRACE card. A detailed discussion of the computer system boot deck used for startup and $ TRACE operations is contained in the GCOS System Startup Manual and in the System Tables Manual. GMC cannot be used to turn on or off a TRACE option. The GMC user must request the computer system manager to change the system boot deck $ TRACE card to meet the minimum GMC requirements. If all the required trace types are not on, GMC will abort with a T0 through T8 and TA abort. The hexadecimal digit immediately following the letter T indicates the monitor number for

which the proper traces are not active. See table 5-1 for a quick reference of required trace types for each monitor and refer to table 5-2 for all GMC abort codes.

5.2.1 Memory Utilization Monitor. The Memory Utilization Monitor (MUM) is used to measure memory utilization. For a detailed description of reports containing data collected by this monitor, see section 6.

When MUM is active it is essential that GCOS system trace types (octal) 10, 11, 46 and 51 are enabled in the computer system boot deck $ TRACE card. MUM collects data upon the occurrence of those traces and builds its records which are then passed to the Executive Routine (ER) for buffering. A separate discussion of the format of the MUM collected data records is contained in subsection 5.4.2. MUM requires that at least the following segment numbers from table 5-3 be used to generate the GMC R* file:1, 2, 11, 19, 23, 26 and 27. The complete process for generating an R* file is described in subsection 5.6. It should be noted that this version of MUM will not collect any idle trace information and therefore not all MUM reports will be produced during data reduction. See section 6 for description of reports that will not be produced.

If the user wants all the MUM reports produced, then the Idle Monitor must be made active, along with the Memory Monitor. To do this, GCOS trace types (octal) 0, 1, 2, 3, 10, 11, 13, 16, 21, 22, 37, 46, 51 and 65 must be enabled. In generating the R* file the following segment numbers should be used: 1, 2, 10, 11, 19, 23, 24, 25, 26 and 27. It should be noted that when the Idle Monitor is active the amount of data collected will be about double that collected when the Idle Monitor is off. The user should carefully evaluate the need for those reports produced by the Idle Monitor.

The MUM is designed so that it can accurately report all changes to the memory subsystem. It does this by processing all trace type 10's (.CALL) and all trace type 11's (.GO TO). Upon receiving these traces a further check is made to see whether a memory allocation process is being requested i.e. the use of SSA modules: .MPOP3,.MPOQ4, or MPOR5. The MUM will collect data only if one of these modules has been requested.

The first item of information reported by the MUM is the current status of all jobs waiting in the Peripheral Allocator's Queue. This information is reported so as to be better able to represent the true core demand being made by the current workload. When a GCOS system has a large number of jobs waiting core, a Core Damper Switch is set. This switch is used to prevent jobs from being sent from the Peripheral Allocator to the Core Allocator. Therefore, the Peripheral Allocator's queue may contain many jobs that would normally be in the Core Allocator's queue, were it not for the Core Damper Switch. This

Table 5-1. Required Trace Type for Each Monitor

Monitor #	Monitor	Required Trace Type
0	Memory Utilization Monitor (MUM)	10, 11, 46, 51, (Idle Monitor traces optional)
1	Mass Storage Monitor (MSM)	7, 15, 73*, 76*
2	CPU Monitor (CPUM)	10, 11, 21, 70*
3	Tape Monitor (TM)	50, 51, 52
4	Channel Monitor (CM)	4, 7, 15, 22 (Idle Monitor traces optional)
5	Communications Analysis Monitor (CAM)	14*, 15
6	GRTS Monitor (GRTM)	62*
7	Idle Monitor (IDLEM)	0, 1, 2, 3, 13, 16, 21, 22, 37, 65
8	Transaction Proc-cessing System Monitor (TPSM)	0, 1, 2, 4, 5, 6, 13, 42, 51, 65, 74*
A	TSS Monitor (TSSM)	74*

*These are not standard traces. They are specially created by the GMC or by an editing of the GCOS TPE Subsystem in the case of trace type 74. Trace types 70, 73 and 76 are direct transfers into the GMC and as such are not required to be active via the $ TRACE card in the system boot deck. Trace types 14, 62 and 74 do use the System Trace Function and require the Trace Number to be active on the $ TRACE card.

Table 5-2. Abort Codes (Part 1 of 3)

B2 -	Illegal snumb on MSM data card (more than 5 characters).
B3 -	More than 5 snumbs for MSM SNUMB option.
BC -	Illegal request on limited connect option.
BK -	Backspace of the full data tape was bad. Multireel will not be collected. Check for tape drive problems.
BS -	Bad tape status. Check condition of tape and rerun job.
C1 -	CPU Monitor turned off but SNUMB input requested on the data card.
C2 -	Illegal SNUMB (more then five characters) on data card for CPU SNUMB option.
C3 -	More then three SNUMBS for CPU Monitor on data card.
CD -	Illegal character in CAM special option.
CE -	Console message garbled. Check console sheet and check with operator.
CM -	Cannot move out of the growth range of TSS.
CO -	CAM turned off but special option requested.
DK -	No multireel disk file was present. Use a $ FILE card in the JCL or use the M9 option to turn off multireel capability.
DR -	Disk read-in. End-of-reel processing was bad.
DS -	Bad status of the disk write.
ER -	Wrapup record could not be written.
ET -	More than two terminals requested for CAM special option.
FN -	The IOS accounting modification could not be found. Call CCTC
GC -	No GRTS control card.
GD -	No FEP I/O can be performed.
GM -	Needed memory for GRTS Monitor denied. Increase $LIMIT card.
GO -	GRTS Monitor illegal data card.
GS -	Extra SSA is not available for GRTS Monitor. Check $ LIMIT card

Table 5-2. (Part 2 of 3)

M0-M8,MA - Monitor was not turned off and not present on the R* file. Any monitor not contained on the R* file must be turned off via the data card option. The number following the M is the monitor that was not turned off.

MM - The dispatcher hook has already been inserted. Another version of GMC must already be in execution.

N1 - The CPU Monitor hook code could not be found. See subsection 5.2.3.

N2 - Sufficient patch space is not available in .MDISP to run the CPU Monitor. See subsection 5.2.3.

N3 - DNWW/MDNET patch location could not be found. See subsection 5.2.6.

N4 - Sufficient patch space is not available in DNWW/MDNET to run the Communication Analysis Monitor. See subsection 5.2.6.

N5 - MSM patch for SSA cache analysis not found (AOS .CRTDL). See subsection 5.2.2.

N6 - MSM patch for SSA cache analysis not found (AOS .CRTBH). See subsection 5.2.2

N7 - MSM patch space in .MDISP not sufficient for monitoring SSA cache. See subsection 5.2.2.

N8 - CPU Monitor hook code for subdispatch could not be found. See subsection 5.2.3.

NF - The Dispatcher hook code could not be found. Call CCTC/C751.

NS - A CAM abort because it could not find NSIP (# of special interrupts) address in .MDNET.

NR - A CAM abort because it could not find R01XCT (number of lines found waiting mailbox) instruction.

OE - An error in an off option was encountered. Check the data cards. There is either an illegal character on the data card or a monitor which was not compiled in the R* file (see assembly listing) has not been turned off.

OK - All went correctly.

OL - Overlap of disk file. Increase size of disk file. Check if operator failed to respond to tape mount message during multiprocessing.

Table 5-2. (Part 3 of 3)

OV - A tally overflow occurred in the MUM.T10 subroutine. Increase the size of the data area within subroutine MUM.T10, variable SIZEBUF.

RS - Routine depth requested exceeded table length.

RW - Error in initial rewind. Check tape and drive.

SB - End-of-reel processing was bad. Check tape and drive.

SD - Error setting of density.

SF - Limited reel option termed successfully.

SQ - Sequence error in the physical records.

S1 - Subroutine MUM.T10 missing

S2 - Subroutine MUM.T46 missing

S3 - Subroutine CM.T07A missing

S4 - Subroutine CPU.T70 missing

S5 - Subroutine CM.T04A missing

S6 - Subroutine CM.T22A missing

S7 - Subroutine TM.T50 missing

S8 - Subroutine CAM.T14 missing

S9 - Subroutine GRT.T62 missing

SA - Subroutine IDL.TRCS missing

SC - Subroutine IDL.T21 missing

SD - Subroutine TPE200 missing

TE - The start/stop times appear improper. Check data card.

TL - Trailer record write was bad. Check tape and drive.

TS - An OK abort directed by a time to stop command.

TW - The tally word has been garbled.

T0-T8,TA - Required system trace is not on. The number following the T indicates the monitor having the problem.

Table 5-3. GMC Catalog and File Index (Part 1 of 3)

SEGMENT #	FILE	REQUIRED	FUNCTION
1	GMF.TOP	Y	Read data card, initialization, find hook in dispatcher, and create initial record
2	MUM.INIT		Initialize Memory Monitor
3	MSM.INIT		Initialize Mass Store Monitor
4	CPU.INIT		Initialize CPU Monitor
5	CAM.INIT		Initialize Communications Analysis Monitor
6	CM.INIT		Initialize Channel Monitor
7	TM.INIT		Initialize Tape Monitor
8	GRT.INIT		Initialize DN-355 Monitor
9	TP.INIT		Initialize TPE Monitor
10	IDL.INIT		Initialize Idle Monitor
10A	TSS.INIT		Initialize Timesharing Monitor
11	GMF.MID	Y	Ensure at least one active monitor
12	CAM.PAT		Preparation for patching DNWW/MDNET for Communications Analysis Monitor
13	CPU.PAT		Preparation for patching dispatcher for CPU Monitor
14	MSM.PAT		Preparation for patching dispatcher for MSM Cache Analysis
15	PATLOOK		Searches for patch space for CPUM, CAM, MSM
16	CPUDOIT		Patch the dispatcher for CPU Monitor
17	CAMDOIT		Patch DNWW for Communication Analysis Monitor
18	MSMDOIT		Patch dispatcher for MSM Cache Analysis

Table 5-3. (Part 2 of 3)

SEGMENT #	FILE	REQUIRED	FUNCTION
19	GMF.MON	Y	Insert the trace hook for GMC traces
20	CPU.REMO		Remove CPU Patches to dispatcher
21	CAM.REMO		Remove CAM patches to DNWW/MDNET
22	MSM.REMO		Remove MSM patches to dispatcher
23	GMF.BTM	Y	Remove the trace hook, do all IO control
24	IDL.TRCS		Processes traces, 0,1,2,3,13,16,22,37, and 65 for Idle Monitor
25	IDL.T21		Processes trace 21 for Idle Monitor
26	MUM.T10		Processes traces 10, 11, and 51 for Memory Monitor
27	MUM.T46		Processes trace 46 for Memory Monitor
28	CPU.T70		Processes traces, 10,11,21, and 70 for CPU Monitor**
29	TM.T50		Processes traces 50,51,52 for Tape Monitor
30	CAM.T14		Processes traces 14 and 15 for CAM*
31	CM.T04A		Processes trace 4 for Channel Monitor
32	CM.T22A		Processes trace 22 for Channel Monitor
33	CM.T07A		Processes traces 7,15,73,76 for Channel Monitor and Mass Store Monitor**
34	GRT.T62		Processes trace 62 for GRTS Monitor*
35	GRT.COL		Interfaces with the DN-355

Table 5-3. (Part 3 of 3)

SEGMENT #	FILE	REQUIRED	FUNCTION
36	TPE200		Processes traces 0,1,2,4,5,6,13,42,51,65 and 74 for TPS Monitor*
36A	TSS.COL		Captures trace 74 for TSS Monitor*
37	RUN.GMF		JCL to run a GMC R*
38	GMF.OBJ		File to contain a GMC R*
39	MAKE.XXX		A series of files creating different GMC R* Monitors.
39A	MAKE.MUC		Memory and CPU Monitors
39B	MAKE.ALL		Total GMC
39C	MAKE.MUM		Memory Monitor
39D	MAKE.CPU		CPU Monitor
39E	MAKE.TM		Tape Monitor
39F	MAKE.MSM		Mass Store Monitor
39G	MAKE.MCC		Memory, CPU, Communications and Idle Monitors
39H	MAKE.MCI		Mass Store, Channel and Idle Monitors
39I	MAKE.CAM		Communications Analysis Monitor
39J	MAKE.CM		Channel Monitor
39K	MAKE.GRT		DATANET-355 Monitor
39L	MAKE.CMI		Channel and Idle Monitors
39M	MAKE.MCM		Mass Store and Channel Monitors
39N	MAKE.GC		Communications and DATANET Monitors
39O	MAKE.TPE		TPE Monitor

*Trace types 14,62 and 74, are not standard. They are internally generated (IT) traces.

**Trace types 70,73 and 76 are not standard. They are direct transfer (DT) traces.

information from the Peripheral Allocator is reported only when the Peripheral Allocator is in memory and a Memory Monitor trace is about to be generated. For this reason, not all Peripheral Allocator queue changes will be reported. In order to reduce the amount of information being collected, a job's status in the Peripheral Allocator's queue is reported only for new jobs, when a job has changed activity, or when its status has changed.

After reporting any Peripheral Allocator status information, the MUM will next report the status of every job waiting for or currently using memory. Information such as the SNUMB, IDENT, USERID, Activity Number, memory demands, current memory address, whether the job is in memory or waiting for memory, and whether the job is a system program or user program is collected. This information is reported for each job only if a change has occurred from previous information that was reported. In addition, the current amount of CPU and IO time used by a job is reported in every MUM trace that is generated.

The MUM will consider a job to be a system job if it has a program number less then octal 10, or if it has no J* file and requires privity. Since the user may want to consider other jobs to be system jobs, such as HEALS or VIDEO, the data reduction program allows the user to extend this definition of system jobs (see section 6).

5.2.2 Mass Storage Monitor. The Mass Storage Monitor (MSM) is used to collect data on usage of peripheral resources. For a detailed description of reports containing data collected by this monitor, see section 7.

When the user wants MSM to be active, it is essential that trace types (octal) 7 and 15 are enabled in the computer system boot deck on the $ TRACE card. MSM processes trace types 7, 15, 73, and 76 to build its own records which are passed to ER. A separate discussion of the format of the MSM collected data records is contained in subsection 5.4.3. As has been stated earlier, trace types 73 and 76 are direct transfer traces created by the GMC, and as such need not be defined on the $ TRACE card. The MSM requires that at least the following segment numbers from table 5-3 be used to generate the GMC R* file: 1, 3, 11, 14, 15, 18, 19, 22, 23, and 33. The complete process for generating an R* file is described in subsection 5.6. If the system being monitored by the Mass Store Monitor contains SSA Cache Core, two new direct transfer traces, are created by the Mass Store Monitor in order to collect sufficient data to be able to analyze the operation of SSA Cache Core. These traces are created only if SSA Cache Core is configured. The Mass Store Monitor searches the dispatcher for a AOS .CRTDL instruction and then inserts code to make a direct transfer into the GMF. In addition, an AOS .CRTBH instruction is also searched for so that another direct transfer into the GMC can be generated. The first instruction locates the area of the dispatcher where it has been determined that the required SSA module is not in the SSA Cache Buffer and needs to be loaded from disk. The second instruction

and 2460. If GMC cannot find the ASA .SALT,5 instruction, it will abort with an N1 abort; if it cannot find the STQ instruction it will abort with an N8 abort. If either abort occurs, the dispatcher code should be examined to determine if either instruction has been modified, moved, or patched. If so, the code in GMC will need to be modified.

Upon finding these instructions, GMC searches the dispatcher patch area(s) for four free locations under WW6.4 or eight free locations under WW7.2 in which to create a direct transfer trace into the GMC. This search has the same ranges as that for SSA cache in MSM. If patch space is not found, an N2 abort will occur. See subsection 5.2.2 for a description of this search procedure.

The CPU Monitor tracks the CPU usage of all system programs and accumulates CPU usage of slave jobs into a single value (see subsection 5.4.4). If the user desires, he can specify up to three slave jobs for which he wants the CPU monitor to track CPU usage, just as it does for system jobs. Subsection 5.5.5. describes this user option.

5.2.4 Tape Monitor. The Tape Monitor (TM) is used to collect utilization statistics on magnetic tape drive activity. A separate discussion of the format of the TM collected data records is contained in subsection 5.4.5. Reports containing data collected by this monitor are described in section 11.

When the user desires that the TM be active, GCOS trace types (octal) 50, 51, and 52 should be enabled in the computer system boot deck on the $ TRACE card. TM processes these trace types to build its records which are passed to the ER. The TM requires that at least the following segment numbers from table 5-3 be used to generate the GMC R* file: 1, 7, 11, 19, 23, and 29. The complete process for generating an R* file is described in subsection 5.6.

5.2.5 Channel Monitor. The Channel Monitor (CM) is used to measure I/O channel activity over tape and disk channels and contention to disk devices. A separate discussion of the format of the CM collected data records is contained in subsection 5.4.6. See section 8 for a description of reports containing data collected by this monitor.

When CM is active, it is essential that GCOS trace types (octal) 4, 7, 15, and 22 are enabled in the computer system boot deck on the $ TRACE card. CM processes these trace types to build its records, which are passed to the ER. The CM requires that at least the following segment numbers from table 5-3 be used to generate the GMC R* file : 1, 6, 11, 19, 23, 31, 32, and 33. The complete process for generating an R* file is described in subsection 5.6.

Actually, when the CM is active, sufficient data is processed for obtaining reports not only from the Channel Monitor but also from the Mass Store Monitor. The only Mass Store Monitor data that cannot be

collected would be the data needed to analyze Cache Memory. If the user also wants this data to be collected, he should create an R* file from the following segments (see table 5-3): 1, 3, 6, 11, 14, 15, 18, 19, 22, 23, 31, 32, and 33. In addition, the Mass Store Monitor must be made active. There is an additional option available with the Channel Monitor. This option allows the Channel Monitor Data Reduction Program to produce a CPU Idle/IO Active Report. This report is described in section 8. To obtain this report, the Idle Monitor must be included in the R* file. In addition, all Idle Monitor traces must be active. The following segments are required to generate the R* file: 1, 6, 10, 11, 19, 23, 24, 25, 31, 32, and 33.

5.2.6 Communications Analysis Monitor. The Communications Analysis Monitor (CAM) is used to measure machine and user response time and terminal usage. A separate discussion of the format of the CAM collected data records is contained in subsection 5.4.7. The complete process for generating an R* file is described in subsection 5.6. The output reports, containing data collected by CAM, are described in section 9. When CAM is active, it is essential that the GMC generated trace type (octal) 14 and the GCOS trace type (octal) 15 are enabled in the computer system boot deck on the $ TRACE card. CAM patches the DNWW (MDNET in W7.2) module, looking for a LDQ M.LID,3 instruction followed by an ANQ =0077777,DU instruction. When the monitor is terminated, CAM removes these patches from the system. The CAM requires that at least the following segment numbers from table 5-3 be used to generate the GMC R* file: 1, 5, 11, 12, 15, 17, 19, 21, 23, and 30.

The method used by the CAM to patch DNWW/MDNET is similar to that used by the CPUM to patch the dispatcher. The CAM searches DNWW/MDNET for the LDQ M.LID,3 instruction beginning at octal location 5000 and ending at octal location 6000 (offsets from the entry point). If CAM cannot find this instruction, GMC will abort with an N3 abort. If this problem occurs, the DNWW/MDNET code should be examined to see if this instruction has been moved out of the octal range 5000-6000 due to an edit or recompile. If so, the code in CAM.PAT will need to be altered.

Upon finding this instruction, CAM then searches DNWW/MDNET patch area for 10 free locations in which to create a new system trace type 14. This search begins at octal location 11100 and continues for 100 octal locations (offsets from the entry point). If 10 free words of space are not found, then seven words of patch space are searched for within the dispatcher. This search occurs between octal locations 3540-3740 in W6.4 or 4600-5000 in W7.2 (offset from the entry point). If no space is found by either of these searches an N4 abort will occur. In this case, the user should examine the patch deck to see if a large number of patches have been made to DNWW/MDNET. If this is the case, DNWW/MDNET will need to be re-edited in order to remove these patches or else the CAM will not be able to be utilized. In addition to the above patching, CAM.INIT also searches DNWW/MDNET for certain

instructions. Beginning at 5100 octal locations from the entry point, and continuing for 100 octal locations, CAM.INIT searches for a 777777375207 instruction. If it does not find this instruction, it will abort with an NS abort. CAM.INIT is searching for a number of special interrupts processed (NSIP). In addition, CAM.INIT will also search for a 000077360003 instruction beginning at octal location 6700 from the entry point and continuing for 100 octal locations. If it does not find this instruction, it will abort with an NR abort. In this section, CAM.INIT is searching for the R01XCT processing (number of lines found waiting mailbox). If a specific terminal's traffic is to be monitored (see subsection 5.5.3), the CAM will insure that no more than two terminal IDs have been included. Invalid terminal IDs, extra terminal IDs or terminal IDs without the CAM input option request will cause the GMC to abort with a CD, CO, or ET abort. See table 5-2 for the meaning of these aborts.

The CAM also uses the GCOS trace type 15 (octal) to check for any JDAC processing or any other line switching which may occur.

5.2.7 GRTS Monitor. The purpose of the GRTS Monitor (GRTM) is to collect statistical data to be used in evaluating the performance of the DATANET 355 Front-End Processor (FEP). This data includes CPU Utilization, Response Time, and Terminal Performance. The collected information is sent to the GMC within the H6000, which writes the data to tape. A separate discussion of the format of the GRTM collected data records is contained in subsection 5.4.8. This tape, containing GRTM performance data and possibly data from other monitors, is used as input to a data reduction program used to produce statistical reports. (See section 10).

5.2.7.1 Configuration Requirements. The GRTM will execute on H6000 system with up to eight FEPs. The monitor is designed to run on the GRTS II Phase IIA (GRTS 1.2) FEP software.

5.2.7.2 H6000 Configuration Requirements. To run GRTM, GCOS trace type (octal) 62 must be enabled via the H6000 computer system boot deck on the $ TRACE card. The GRTM requires that at least the following segment numbers from table 5-3 be used to generate the GMC R* file: 1, 8, 11, 19, 23, 34, and 35. The complete process for generating an R* file is described in subsection 5.6.

5.2.7.3 Altering of Phase II-A Software. To use the GRTM, the user must modify the standard GRTS software by applying a set of alters supplied with release of the GMC software. It should be noted that in Release WW7.2 the alter cards to support the monitor are included within the standard release. The user must check the FMAC module to insure that variable FMON has been set to 1. The FMAC module must be recompiled and the macro library reloaded. Finally, all the GRTS modules should be recompiled.

B29IDPXO
GMFCOL

MAK.XXX	GMF.OBJ	PATLOOK	GMF	MUM	MSM	CM	CPU	TM
			GMF.TOP	MUM.INIT	MSM.INIT	CM.INIT	CPU.INIT	TM.INIT
			GMF.BTM	MUM.T10	MSM.PAT	CM.T04A	CPU.PAT	TM.T50
			GMF.MID	MUM.T46	MSM.REMO	CM.T22A	CPU.T70	
			GMF.MON		MSMDOIT	CM.T07A	CPU.REMO	
							CPUDOIT	

Figure 5-2. GMC Catalog File Structure (Part 1 of 2)

B29IDPXO

GMFCOL (Continued)

CAM	GRT	IDLE	TPE	TSS
CAM.INIT	GRT.INIT	IDL.INIT	TP.INIT	TSS.PAT
CAM.REMO	GRT.T62	IDL.TRCS	TPE200	TSS.COL
CAM.PAT	GRT.COL	IDL.T21		TSSMON
CAM.T14				TSS.INIT
CAMDOIT				TSGMF

Figure 5-2. (Part 2 of 2)

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5.2.7.4 FEP Configuration Requirements. The modified GRTS II software will produce performance data. These modifications are then enabled in the software through the use of the following control card during FEP system initialization:

CCl

```
1      8      16
$      GOPT   RCSMON
```

When the monitor is not running, the FEP will function normally. Execution of the GRTM is initiated by the H6000 as it connects to each FEP to be monitored. At that time, instructional parameters are sent to each FEP to be used in determining the amount of buffer space needed for the collection of the statistical data.

The GRTM software when configured will require an additional 1,000 (decimal) words of DATANET main memory to execute. This core requirement can grow to as much as 2,500 decimal words depending upon the input options selected. The main portion of the monitor code will be resident within the GRTS II FSUB module with additional patches being incorporated within the FCCP, FEXC, FCIP, FINT, FICM, and FHCB modules. It should be noted that when the monitor is not assembled, the 1-2K of core required for the monitor will be available for buffer space. This should be kept in mind when reviewing the output reports.

5.2.7.5 Interface Requirements. During its initialization phase, the GRTM software will attempt to log onto the H6000 system via a pseudoterminal that is used in its interaction with the host-resident GMC program. Due to .MSECR requirements, the pseudoterminal attempting to gain access to the system must be on a .MSECR configured SYSTEM HSLA subchannel. The Physical Terminal Address (PTA) used by the pseudo terminal is unique and therefore cannot be configured in the GRTS II configuration deck for any other purpose.

The format of this PTA word is as follows:

BITS	MEANING
0-3	IOM CHANNEL NUMBER OF HSLA
4-5	HSLA NUMBER (1,2,3)
6-10	HSLA SUBCHANNEL NUMBER (0-31)
11-15	POLLED SCREEN NUMBER
16-17	MUST BE ZERO

System. A separate discussion of the format of the TPSM collected data records is contained in subsection 5.4.10. The reports containing data collected by TPSM are described in section 12.

When TPSM is active, the required traces must be enabled in the computer system boot deck on the $ TRACE card (see table 5-1). A sample of the reports and run time procedures for the data reduction program can be found in the Transaction Processor System section 12. The TPSM requires that at least the following segment numbers from table 5-3 be used to generate the GMC R* file: 1, 9, 11, 19, 23, and 36. The complete process for generating an R* file is described in subsection 5.6.

NOTE: The TPSM cannot be run concurrently with the TSSM.

5.2.9.1 <u>TPS Trace Collection</u>. The TPSM is unlike most other GMC monitors in that monitoring of the Transaction Processing System is controlled via the operator console. Prior to collecting data, the user must alter the TPS (see subsection 5.2.9.2) and must also create a usable GMC R* file (see subsection 5.6). Once these actions are performed and a GMC execution is started, the user must still perform one additional action before data collection can begin. The TPSM is turned on or off by the console operator via the TP MESS command. The operator must request "TP MESS". When the console responds "TP MESS?", the message "TRACE ON" is entered to start processing traces, or "TRACE OFF" to discontinue trace processing. This procedure can be repeated as often as desired. The TPSM and the TSSM are the only GMC monitors that can be turned on or off while the GMC is physically executing.

5.2.9.2 <u>Modifying the Transaction Processing System</u>. To use the TPSM, the user must alter the Transaction Processing System. An alter file is provided with the GMF software delivery. The file name is B29IDPXO/SOURCE/TPEALT. This file contains all alters and associated JCL necessary to modify the standard TPS. These modifications apply only to the WW7.2 version of TPS. The user will need to make minor modifications to the file so as to correctly reference any permanent files that are required.

5.2.10 <u>Timesharing Subsystem Monitor</u>. The Timesharing Subsystem Monitor (TSSM) is used to measure TSS performance. Section 15 (not yet published) details those reports available from the data collected by this monitor.

When TSSM is active, GCOS trace type 74 (octal) must be enabled on the boot deck $ TRACE card. The TSSM causes the trace to be taken from many points in TS1; the collector builds its records which are then passed to the ER for buffering. An example of the record format appears in subsection 5.4.11. TSSM requires the following segment numbers from table 5-3 be used to generate the GMC R* file: 1, 10a, 11, 19, 23 and 36a. Subsection 5.6 shows how to generate an R* file.

If all TSSM reports are wanted, then both the CPU Monitor and Channel Monitor are additionally required: GCOS trace types (octal) 4, 7, 10, 11, 15, 21 and 22 must also be enabled. Restricting Channel Monitor activity to SNUMB TS1 will conserve tape and GMC overhead. The TSSM and TPSM cannot be run concurrently.

The TSS Monitor consists of two major pieces of software: a data generation program loaded into TSS and a data capture routine loaded along with GMC routines. The TSS Monitor is used to analyze periods of poor TSS response to determine which users are affected, when and for how long they are affected, and what the possible causes of the poor response are. To collect information for such analysis, probes are inserted throughout TSS to gather individual pieces of information which, when combined by a data reduction program, yield the desired result. When active, the TSS Monitor is an area of code entered via transfer instructions planted throughout TSS by an initialization routine. After the TSS Monitor is entered from a probe point, it makes an entry in the GCOS trace table and then returns to the TSS process which was executing. The places where transfers are made fall into the following categories:

- Session identification and correlation - retrieval of line ID, DRUN, ID, USERID and User Status Table (UST) address (the unique identifier which is used to correlate traces coming from an individual session)

- Type of user interaction - retrieval of subsystem names, indication of build mode, memory sizes, derail codes

- Terminal I/O - a single location where I/O is started and a number of locations where courtesy calls for I/O complete are paid

- Disk I/O to user files - a single location where I/O is started and a number of locations where courtesy calls are paid for I/O complete

- FMS service - pairs of locations, one where TSS issues a request for service, and the other where the service is complete; the second location also gives an FMS status to tell whether the service was actually performed or why it was denied

- Processor allocation - locations for entering the processor allocation process, placing an entry into the subdispatch ready queue, and removing an entry from the subdispatch fault queue

- Memory allocation - retrieval of subsystem size; recording of the flow of control in the memory allocation and swap processes

- Errors and denials - retrieval of numeric error codes, recording of individual denial events

- Intervals of no TSS service to individual users - locations for recording line switches, DRL TASK jobs, wait disposition for batch jobs, console interaction for master user

- Intervals and events for the TSS executive - release of processor to allow subdispatch to start, execution of MME GEWAKE when there is no work to do, processing of TSS queue entries including TRACE ON and OFF, processing of terminal log-on requests prior to UST assignment

- Denials seen by the TSS executive - swap space denial, memory allocation denials, deadlock with other batch jobs at the remote inquiry MME GEROUT

- Unusual conditions - places where TSS recognizes that an error has occurred, errors such as bad terminal status, inability to assign a UST within 15 seconds, maximum number of users or VIPs logged on.

5.2.10.1 Locations of TSS Trace Points. The following is a list of trace numbers, modules and symbolic locations provided with the TSS Monitor source code. The monitor has these locations coded as offsets relative to the beginning of the respective modules. During execution it retrieves the TSS load map and relocates these offsets. The current monitor uses offsets for W7.2.0 level 4. In future levels and releases, the symbolic locations will probably remain constant, but some octal offsets into the modules may change.

Trace	Module	Location	Instruction	Description
1	TSSB	.EV7+2	LDA .TSTOD	Log-on complete

Data: UST address, line ID
Use: First correlation of UST address with line ID (UST address used in all future traces for this session)

Trace	Module	Location	Instruction	Description
2	TSSC	DRM998+1	TRA 0,1	Swap space denied

Data: UST address
Use: Trigger resource denial report entry

Trace	Module	Location	Instruction	Description
3	TSSD	PATDP+3	LREG REGSAV	PAT denial

Data: UST address, flag (=0, no PAT space; |0, duplicate file name)
Use: Trigger resource denial report entry

4	TSSD	PD621+18	LDA 2,DL	GEFSYE deallocate

Data: UST address
Use: Open interval closed by trace 5

5	TSSD	PDCC+5	CMPX1 =0404600,DU	GEFSYE deallocate complete

Data: UST address, status
Use: Trigger entry in FMS report if status is octal 404600 (SMC busy) SMC wait interval is FMS status trace, 30 or 31 (wait), FMS status trace, ..., until status not octal 404600

6	TSSG	PNTTSX+9	LDAQ .LFNAM,2	Print error message

Data: UST address, error code (binary)
Use: Trigger entry in error report, possibly conditionally based on error number

82	TSSH	COMCL+4	CMPA =040000,DU	Scan command list

Data: UST address, command text
Use: Connect command (e.g. RUN) with subsystem loaded (e.g. CDIN)

64	TSSH	INTRP1+1	CANQ .FBT23,DL	Interpret primitive

Data: UST address, current program stack tally, flag for 40 file permission, primitive number (1-11)
Use: If flag set, explain return to top of stack; trace primitives not recorded by traces 8, 9, 10, 11, and 85 (e.g. XCALL, combination of CALLP, EXEC, and BIN)

7	TSSH	POPPR1+2	CMPXO POPPR1	POPUP primitive

Data: UST address, current program stack tally, subsystem name (ASCII)
Use: Cause pointer in stack of subsystem names for user to be backed up; verify subsystem name in table against name in trace

85	TSSH	POPPR1+21	LDQ 2,AU	DRL CALLSS complete

Data: UST address, subsystem name (ASCII)
Use: Cause pointer in stack of subsystem names for user to be backed up; indicate that subsystem issued DRL CALLSS and must be swapped back in

8	TSSH	CAL10+2	LDA 2,DL	CALLP primitive

Data: UST address, program stack tally, subsystem name (ASCII)
Use: Cause pointer in stack of subsystem names for user to be pushed down and name recorded (tally used to verify depth; no pushdown for DRL T.GOTO or DRL CALLSS immediately followed by DRL RETURN)

```
 9    TSSH    RSPRM+5    LDA -1,DU           Enter build mode

Data:  UST address, program stack tally
Use:  Cause entry to be made in stack of subsystem names; remove entry
      from stack when trace 13 is received

 10   TSSH    LODPRM+9   TNC SCERR6          EXEC primitive

Data:  UST address, program stack tally, subsystem name (ASCII)
Use:  Set flag to indicate actual code executed (as opposed to
      subsystems CARD, FORT, MDQ, etc.)

 11   TSSH    SYSPRM+4   LDA .LBUF,2         SYSTM primitive

Data:  UST address
Use:  Clear stack of subsystem names

 12   TSSI    CU1CF+7    EAX1 .LCALS,2       Log-off

Data:  UST address
Use:  Terminate processing of session, release UST address

 13   TSSI    STARTP+3   LDA 0,3             Command received

Data:  UST address, command text (ASCII)
Use:  Record last user build mode command for session snapshot
      reports; end build mode; clear subsystem name stack if command
      is "NONE" and does not come from DRL CALLSS or DRL T.GOTO

 14   TSSJ    LOGON+1    CANA =07777,DL      Periodic check

Data:  Line ID if new user waiting
Use:  Produce report entry if time interval between trace 102 and this
      one too great

 15   TSSJ    LOG11+3    STQ BYTIME          GEWAKE - no users

Data:  Length of GEWAKE (clock pulses)
Use:  Force clearing of tables in data reduction program; opens
      interval closed by trace 61

 16   TSSJ    LN100+2    STA .LKST,2         Break or disconnect

Data:  UST address, GEROUT status (binary)
Use:  Set flag for reconnect if status 2 (disconnect); simulate input
      complete if break and if I/O complete trace has been processed
      (user initiates request for service with break as in DJST)
```

17	TSSJ	.SSDSP+7	TNC TYTSS	GEWAKE until subdispatch done

Data: Length of GEWAKE (clock pulses)
Use: Formatted dump or accounting for GEWAKEs; opens interval closed by trace 61

18	TSSJ	TYTSS	STQ SLEEP	GEWAKE with subdispatch busy

Data: Length of GEWAKE (clock pulses)
Use: Formatted dump or accounting for GEWAKEs; opens interval closed by trace 61

19	TSSJ	QSPEC	EAA SPEC	All Points Bulletin or remote I/O courtesy call

Data: UST address, flags (.LFLG2) for CRUN/DRUN, GEROUT status
Use: Completes terminal I/O started by trace 100

20	TSSJ	STGCC+5	CMPA 4,DL	Build mode input received

Data: UST address, flags (.LFLG2), GEROUT status
Use: Completes terminal I/O started by trace 100

21	TSSJ	DSTAT+4	LDA .LIOST,2	SY** I/O complete

Data: UST address
Use: Completes disk I/O started by trace 24

22	TSSJ	RECON2+1	CANA .FK19,DL	Place user in reconnect mode

Data: UST address, flag for data in transmission
Use: Positive assurance that session is being put in hold (not given by trace 16)

59	TSSJ	PPTCC2+2	STZ .LCC,2	Disk I/O for tape mode complete

Data: UST address
Use: Completes disk I/O started by trace 24

104	TSSK	RETSBS+1	SZN .LSFLG	DRL processing complete

Data: UST address, A-register status if DRL T.SYOT or DRL TASK, Q-register status if DRL SPAWN or DRL PASFLR, DRL number if status reported
Use: End DRL processing state; report unusual status conditions

23	TSSK	EXDRL2+2	CWL 0,3	Process DRL

Data: UST address, flag for data in transmission, DRL number, instruction counter
Use: Make entry into circular table for trace of last user activity; indicate roadblock for terminal I/O if restricted number; clear subsystem name stack if DRL SYSRET

24	TSSK	LINK+3	LDA TSXSW	Request file I/O

Data: UST address, flags for user I/O, trace made at courtesy call level, return address within range, module number for return address or actual return address, I/O queue address
Use: Common point for issuing I/O to files in a user's AFT; traces for I/O complete are 21, 25, 33, 35, 39, 43, 51, 53, 54, 59; queue address can be cross referenced to channel monitor traces; return address information can be used to ignore traces for which there will be no termination trace (calls from TSSN, module number=14 for CRUN I/O, for example)

25	TSSK	DIOCC+1	STZ -1,3	Disk I/O complete

Data: UST address
Use: Completes disk I/O started by trace 24

26	TSSK	DFRET1	EAQ 0	Denial from DRL DEFIL

Data: UST address, denial code
Use: Trigger resource denial report entry based on denial code value

27	TSSK	FILC+7	STA 3,7	Issue MME GEFSYE

Data: UST address, FMS function code
Use: Open interval closed by trace 29

28	TSSK	FRETC+1	STX3 0,1	GEFSYE denied - bad FILACT parameter

Data: UST address, denial code
Use: Enter into table of events for individual sessions

29	TSSK	FILCC+22	LDX4 0,7	Courtesy call for trace 27

Data: UST address, FMS status
Use: Closes interval opened by trace 27; triggers entry in FMS report if status is octal 404600 (SMC busy); opens SMC wait interval if status is octal 404600 until status changes

30	TSSK	DELY1	STQ .LTEMP,2	DRL delayed 200 ms

Data: UST address
Use: Verifies SMC wait interval

31	TSSK	DELY2+3	LDQ 2,DL	DRL delayed 2 seconds with DRL GWAKE

Data: UST address
Use: Indicates following DRL GWAKE is for SMC wait and is not coded in user program

32	TSSK	USER+1	STAQ .LID,2	Store USERID in UST

Data: UST address, DRUN ID or zero, USERID (obtained by GMC capture routine)
Use: First time USERID is available for a session; DRUN ID not available when log-on trace is made

33	TSSK	PBIOCC+2	LDA .LIOST,2	SY** I/O (PASUST, code -1) complete

Data: UST address
Use: Completes disk I/O started by trace 24

34	TSSK	MOR2+1	LDX1 RETFLG	DRL MORLNK error

Data: UST address, error code
Use: Trigger resource denial report entry or enter into table of events for user

35	TSSK	CC.1+2	STZ .LCC,2	I/O for DRL SPAWN or PASFLR complete

Data: UST address
Use: Completes disk I/O started by trace 24

36	TSSK	PASGD+4	ANA -1,DL	Batch job submitted

Data: UST address, SNUMB, wait disposition flag
Use: Enter into table of events for user; explain delay if trace 60 follows

37	TSSK	PSFLX+1	STQ 5,1	Error in DRL SPAWN

Data: UST address, error code
Use: Enter into table of events for user

38	TSSK	WRTABT+1	CANA .FP19,DL	Enter routine to write dump to ABRT

Data: UST address
Use: Provide reason for following disk I/O

39	TSSK	ABT70+1	STZ .LSWAP+1,2	ABRT file I/O complete

Data: UST address
Use: Completes disk I/O started by trace 24

40	TSSK	RESTOR+12	AOS 5,1	Increment number of executions for subsystem load via DRL RESTOR

Data: UST address, subsystem name (ASCII)
Use: Provide information on what user is doing

41	TSSK	RES20+12	STA .LSWAP+1,2	Load subsystem with DRL RESTOR

Data: UST address
Use: Open interval for disk I/O not covered by trace 24, closed by trace 42

42	TSSK	RESCC+4	STZ .LSWAP+1,2	Subsystem load complete

Data: UST address
Use: Close interval opened by trace 41

43	TSSK	RESCCX	STZ .LSWAP+1,2	Permanent file I/O from DRL RESTOR complete

Data: UST address
Use: Completes disk I/O started by trace 24

44	TSSK	CGROT1+4	STA 1,3	Start line switch

Data: UST address, JDAC switch (wait), BCD name
Use: Start roadblock interval if switch set (indicated by trace 60); provide information about what user is doing

45	TSSK	GROW01+2	SXL5 .LTEMP,2	Call .MFS19 for file grow

Data: UST address
Use: Open interval closed by trace 46

46 TSSK GROWCC+4 CMPX4 =0404600,DU File grow complete

Data: UST address, FMS status
Use: Close interval from trace 45; open SMC wait interval if status is octal 404600

47 TSSK CONO15+2 LDA 4,DL Start console I/O for DRL CONSOL

Data: UST address
Use: Open interval closed by trace 60

48 TSSK JSNUM4 LDA 2,3 Return from DRL JOUT

Data: UST address, status
Use: Report along with other return codes if -1 (batch system full) or 1 (lost PAT)

49 TSSK JSNUM7+6 LDA =0000200,DU Output busy status for DRL JOUT

Data: UST address
Use: Report along with other return codes

50 TSSK GWAKE+4 SXL1 .LBACK,2 Start DRL GWAKE

Data: UST address, time (seconds)
Use: Explain part of interval involving no user interaction

51 TSSK TSKCC+2 STZ .LCC,2 I/O for *J write for DRL TASK complete

Data: UST address
Use: Completes disk I/O started by trace 24

52 TSSK TSK325+5 LDA 4,DL Start DRL TASK

Data: UST address, SNUMB
Use: Opens interval for user roadblock indicated by trace 60

53 TSSK TSKCC1+2 STZ .LCC,2 I/O for *J read for DRL TASK complete

Data: UST address
Use: Completes disk I/O started by trace 24

54 TSSK TRUECC+3 STZ .LSWAP+1,2 I/O for DRL SAVE complete

Data: UST address
Use: Completes disk I/O started by trace 24

55	TSSK	ATTRI1+5	STZ 0,0	Call .MFS13 for IDS attributes

Data: UST address
Use: Opens interval closed by trace 56

56	TSSK	ATTRCC+4	CMPX4 =0404600,DU	Status from IDS attributes

Data: UST address, FMS status
Use: Closes interval opened by trace 55; starts SMC wait if status is octal 404600

57	TSSK	SYTE1	STA 4,0	Denial from DRL T.SYOT

Data: UST address, denial code
Use: Report along with other denial codes

58	TSSK	DC1.0+29	LDA .LRTLL,3	UST address switch with DRL T.CONN

Data: Old, new UST addresses
Use: Informs data reduction program to perform same switching function

60	TSSL	ALLOC	AOS A.TRCT	Allocator services

Data: UST address, function code, flags (.LFLAG)
Use: Closes intervals for some DRL processing; opens and closes intervals for non-TSS processes

61	TSSL	LINSRV	LDX3 .QFHT+.TSSDQ	Enter processor allocation

Data: Contents of index register 2 (last UST address)
Use: Closes intervals opened by traces 15, 17, and 18; if after trace 23 for DRL TASK, no pushdown file available; ends DRL processing state for some DRLs

62	TSSL	MAP+10	SZN A.URWT	Enter memory allocation

Data: Flags for urgent user present, fence up too long
Use: Provide information in dump for analyzing memory allocation flow

77	TSSL	MAP.4+2	EAA 0,3	Attempt memory allocation

Data: UST address, program size
Use: Provide information on current TSS memory demand, initiate memory wait for user

63	TSSL	SDP+1	LDA .LSIZE,2	Enter swap decision processing

Data: None
Use: Compute memory demand ratio of number of trace 63 versus number of trace 62

65	TSSL	SDP.4+6	CMPA .TASCF	Consider TSS size increase

Data: Indicator register (carry bit)
Use: Provide information for swap flow of control

66	TSSL	SDP.4C+3	AOS .TSIRC	Initiate size increase for urgent user

Data: UST address for most urgent user, new TSS size
Use: Count occurrences of trace; provide information for swap flow of control

67	TSSL	SDP.5A+6	STA A.LUTM	Set up fence for urgent user

Data: UST address
Use: Count occurrences of trace; provide information for swap flow of control

68	TSSL	SDP.5C+4	CMPX1 A.URMR	Set up urgent user class memory reserve

Data: UST address, size of urgent user class memory reserve
Use: Count occurrences of trace; provide information for swap flow of control

69	TSSL	SDP.7+2	LDXO 1,DU	Force swap

Data: UST address for user force swapped
Use: Count occurrences of trace; provide information for swap flow of control

70	TSSL	SDP.8	LCA .FL34+1,DL	Terminate swap process

Data: UST address of user which could not be swapped
Use: Count occurrences of trace, give TSS snapshot ("system is in trouble")

```
 71     TSSL     SPMACT+10  ASA 1,3                UST area increase by 1K

Data:  None
Use:  Deduct 1K from memory available for user programs

 72     TSSL     SPM.2A+11  ARL 10                 Issue GEMORE for memory

Data:  Number of K words requested
Use:  Provide flow of control information; give explanation if trace
      75 follows immediately

 73     TSSL     SPM.2B+3   ALS 1                  GEMORE successful

Data:  Number of 512-word blocks added
Use:  Completes interval opened by trace 72; adds to memory available
      for user programs

 74     TSSL     SPM.3+22   QLS 9                  Memory release

Data:  Number of words released
Use:  Deduct from memory available for user programs

 75     TSSL     SPM.5      LDA .TSTOD             GEMORE refused or
                                                   reduction not possible

Data:  None
Use:  Count occurrences of trace; indicates GEMORE refusal if trace 72
      precedes

 78     TSSL     MMV.1A+6   ANQ =0777000,DL        Memory map change

Data:  UST address, subsystem size and LAL, extra buffer memory LAL
Use:  Completes memory wait for user or indicates memory release

 79     TSSL     SWOUT+3    ALS 18                 Swap user program

Data:  UST address, program size
Use:  Provide flow of control information (may be able to delete trace
      if 80 sufficient)

 80     TSSL     .ATCHG+12  LDA -1,3               Change time types

Data:  UST address, old and new time types (range 61-66 for non-useful
       memory residence time, swap/load time, useful memory residence
       time, out of memory time, waiting for normal memory allocation
       time, waiting memory allocation after forced swap time)
Use:  Maintain state of user interaction
```

81	TSSL	STB.2+4	LDA BUFSIZ,DU	Request extra buffer memory

Data: UST address
Use: Open interval closed bvy trace 78 or 83

83	TSSL	STB.4	ORSA .LPQF,2	EBM refused

Data: UST address, flags (bit 20=1, no memory; bit 21=1, buffer full)
Use: Ignore if bit 21 of flag=1; count and terminate interval from trace 81 if bit 20=1

84	TSSL	KICC+2	SZN .TCCMT	Terminal input complete

Data: UST address, flags (.LFLG2), GEROUT status
Use: Completes terminal I/O from trace 100; indicates whether user is receiving output on terminal

86	TSSL	APBCC+3	CANA 2,DL	All points bulletin complete

Data: UST address, flags (.LFLG2), GEROUT status
Use: Completes terminal I/O from trace 100

87	TSSL	KSTAT+1	EAX2 -.LKCC-1,3	Terminal I/O complete

Data: UST address, flags (.LFLG2), GEROUT status
Use: Completes terminal I/O from trace 100

88	TSSM	EXENTR+30	CANQ =0200000,DL	Remove entry from sub-dispatch fault queue

Data: UST address, fault type, processor time used (clock pulses), I/O interrupt flag
Use: Completes interval opened by trace 91; provides information for formatted dump

89	TSSM	EXTSQ	STX1 EXTSR,$	Enter routine to process queue

Data: None
Use: Maintain intervals between these traces; report if time excessive

90	TSSM	EXTVRB+1	STA EXTS6F+5	Process unrecognized console verb

Data: If TRACE ON, UST address, USERID, line ID, DRUN ID, program stack (subsystem names), subsystem BAR and LAL, time type, flags (.LFLG2, .LPQF, .LFLAG), log-on time, EBM address, swap area size for all TSS users (obtained by GMC capture routine;

TSS passes flag to GMC to write initialization records or GMC writes initialization records after it has recovered from a lost data condition)
If TRACE OFF, flag (=0)
If bad console input, no trace

Use: Initialize tables in data reduction program

91	TSSM	RETS3X+6	CMPX1 1,DU	Make subdispatch entry

Data: UST address
Use: Open interval closed by trace 88

92	TSSN	GUST1+2	CMPA .LTSRI,DL	Process log-on request

Data: Line ID (octal 2020 if deferred), reject flags (.TLFLG bit 32 or 35)
Use: Open interval closed by trace 1

93	TSSN	GUST21+15	TRA GUSTR-1	Reject user - bad line status

Data: Line ID
Use: Report along with log-on rejections (this is an exotic line condition trace)

94	TSSN	GUST2A+4	CMPQ =030000,DU	Check for VIP as terminal type

Data: Terminal ID, type, number of VIPs allowed (.T760), number logged on (.TL760)
Use: Explain trace 96 if it occurs

95	TSSN	GUST4+4	CMPQ GUSTT	Check UST wait time

Data: Line ID, flag if wait greater than 16 seconds
Use: If flag set, report as log-on reject

96	TSSN	GUSM+5	STA 2,3	Reject user

Data: Line ID
Use: Report trace if not already done

97	TSSN	MUST3+2	AWDX ,2,0	UST compression

Data: Old, new UST addresses
Use: Update UST-oriented tables with new address

98	TSSN	ASGCC1+4	ASQ 1,0	UST area increase by 1K

Data: None
Use: Decrement amount of user memory available

99	TSSN	RELW03+18	ASA 1,0	UST area decrease by 1K

Data: None
Use: Increment amount of user memory available

100	TSSN	RIO.1A+2	LDA .LBUF,2	Terminal I/O request

Data: UST address, GEROUT opcode, CRUN flags (.LFLG2)
Use: Open interval closed by trace 19, 20, 84, 86, 87, or 103

101	TSSN	R.SFOK+2	LXL1 -1,6	Process command file $*$ function

Data: UST address, text (ASCII)
Use: Provide information to explain changes in .LFLG2 or to explain trace 6

76	TSSN	TRMCF+7	EAQ 0,AU	Cancel CRUN mode

Data: UST address, flags (.LFLG2)
Use: Force clearing of subsystem name stack

102	TSSN	IRINQ+4	LDX1 =0050000,DU	Issue remote inquiry GEROUT

Data: None
Use: Open interval closed by next trace; if long time, indicates roadblock of TSS in .MROUT because a table is full

103	TSSO	760CC+3	CMPA 4,DL	VIP input complete

Data: UST address, flags (.LFLG2), GEROUT status
Use: Completes terminal I/O started by trace 100

5.2.10.2 Formats of TSS Traces. The collection routine executing within TSS passes two-word traces to GMC through the dispatcher trace mechanism. In all but four trace subtypes, GMC stores the A and Q registers after a record control word and RSCR time to form a four-word logical record. For subtype 24, GMC edits the Q register before making a trace. For subtype 32, GMC additionally retrieves the USERID and appends it to form a 6-word logical record. Subtype 105 is generated internally by GMC when it senses a period of no TSS activity. Logical records generated as a result of receipt of a subtype 90 trace may have 3 different formats. The first format is written whenever TSS passes a subtype 90 trace to GMC indicating that the TSS traces have been turned off. GMC passes this trace to the data tape in the standard format described above. The following 2 formats apply to a group of logical records written by GMC whenever it

recovers from a lost data condition or whenever TSS passes a subtype 90 trace indicating that TSS traces have been turned back on. In the latter case, GMC formats a series of logical records; one 16-word record is written for each user logged onto TSS to give such attributes as UST address, line ID, USERID, and current program stack. A four-word record which indicates the TSS swap area limits is the last record written by GMC in the sequence of records. If no users are logged on to TSS and if TSRI is not running, only the four-word record is written. The Monitor source code gives the formats of all TSS record subtypes.

5.2.10.3 Installation Procedures

5.2.10.3.1 Description of Monitor Software. The TSS Monitor program element executes as a TSS master subsystem. When the master user logs on and requests the program via "SYST GMF", it first performs address relocations needed to convert relative offsets into actual slave addresses. Then it verifies that the instructions at the trace points match those in the monitor coding (the originals have transfer instructions patched over them when the monitor is executing). Any mismatches found are reported on the master terminal and verification continues. If any mismatches are found, the subsystem terminates without making any modifications to TSS. If verification succeeds, the master subsystem copies part of itself (about 1K memory) into an area of module TSSO which was reserved by means of patches on the TSS INIT file. The origin of this area is the UST address origin which TSS would have used were the patch not applied. Next, the master subsystem applies Execute Double (XED) instructions to most trace points to save the return address and indicator register. In a few rare cases, unconditional transfer instructions are used. The master subsystem terminates at this point. As TSS continues execution, traces will be formatted, but a switch prevents GCOS traces from being written. If the console operator enters "TS1 TRACE ON", GCOS traces will be written from TSS, and an additional overhead will be imposed on TSS. The console operator can stop generation of TSS traces with "TS1 TRACE OFF". The traces can be turned on and off multiple times.

5.2.10.3.2 Software Installation. When TSS is loading the monitor subsystem, it must be able to access the program element using a MME GECALL to a BCD name of .TSGMF. The program element may reside either on a system file defined in the EDIT and FILES sections of the boot deck or on a permanent file (B29IDPXO/GMFCOL/TSS/TSSMON) dynamically accessed during TSS startup. Use of a permanent file requires additional patches in the TSS INIT file. This is the current method of implementation because it does not require changes to the GCOS startup deck. The job stream used to create the program element is located on file B29IDPXO/GMFCOL/TSS/TSGMF.

If the system file option is to be used, the $ PRMFL Q* card on file TSGMF must be replaced with a $ TAPE Q*,X2D,,,,TSSMON card. The startup file must be defined in the EDIT section of the boot deck as follows:

```
$      FILDEF   ST1,TSSMON,12/0,SYS,1T1
```

The tape drive name 1T1 must be appropriate to the hardware configuration. If this startup file is appended onto an existing edit tape, replace "1T1" with "*". In the FILES section, insert the following card in front of existing $ SYSTEM cards:

```
$      SYSTEM   TSSMON
```

If a permanent file is used, no changes need to be made to the boot deck, and no system interruption occurs during installation of the TSS Monitor.

5.2.10.3.3 Software Activation. The purpose of this section is to describe how TSS builds tables so that the master user can find a subsystem named "GMF".

5.2.10.3.3.1 Overview of TSS INIT File Changes. The TSS INIT file is a quick access permanent file named TS1 normally residing under USERID OPNSUTIL, the default USERID for TSS and patchable as symbolic location .TUSER. File TS1 is read as soon as TSS starts in order to pass parameters for the current loading of TSS or to allow symbolic specification of site option patches such as the maximum number of concurrent users. The TS1 file has two sections: $INFO to symbolically define site option parameters, and $PATCH to apply patches to TSS beyond those already in the PATCH section of the boot deck. Installation of the TSS monitor requires that patches be placed at the end of the TSS INIT file. These patches are located on file B29IDPX0/GMFCOL/TSS/TSS.PAT.

5.2.10.3.3.2 Definition of the Master Subsystem Name. The following three patch cards, included in file TSS.PAT, overlay an unused program descriptor in TSSA to define a subsystem named GMF with an edit name of .TSGMF and attributes .BPRIV (can execute privileged DRLs, not currently used), .BMAST (master subsystem), and .BMASX (permission to alter TSS executive with a DRL instruction, not currently used):

```
6724   OCTAL   147155146040   GMF                  .MTIMS
6725   OCTAL   336362274426   .TSGMF               .MTIMS
6726   OCTAL   40003          MASTER SUBSYSTEM     .MTIMS
```

5.2.10.3.3.3 Definition of the UST Origin. The following two patches, included in file TSS.PAT, disable the check for overlaying VIP code in TSSO when no VIPs are configured. They define the UST

origin to be at location 3760 with respect to the beginning of TSSO. The first patch NOP's out a conditional transfer instruction around an instruction which loads a UST origin corresponding to the case when VIPs are configured. The letter "O" in these patches means that the patch locations are with respect to the origin of TSSO, not to slave address 0 of TSS as in the subsystem attribute patches. The letter "R" before patch content indicates that the address field of the patch must be relocated to the beginning of the module (TSSO) identified in column 7 of the patch. The symbolic addresses for these patches are IN7630+2 and IN7630+3. The following patches complete the TSS INIT file when the TSS Monitor is loaded on a startup file:

```
5271  OOCTAL   11007            DON'T TRANSFER IF NO VIPS      .MTIMS
5272  OOCTAL   R3760235007      ALLOW 1K FOR GMF               .MTIMS
```

5.2.10.3.3.4 Installation from a Permanent File. The principle of this method is that if a job has a file code ** active, any MME GECALL will cause that file to be searched before the system files are searched. Patches on the TSS INIT file must access a permanent file before subsystem loading begins and release it after subsystem loading finishes. The TSS User Derail Loader (TUDL, SDN K79005) provides an example of how to access and release a system loadable file from within the TSS executive. The patches on the TSS INIT file for the TSS Monitor are compatible with TUDL because TUDL starts its work after the TSS Monitor has finished its work. TUDL may further relocate the UST origin upward, but TUDL uses the address stored by the TSS Monitor patches. A list of an entire $ PATCH section is given in the TSSM source code. The first four patches match ones described in earlier sections.

The bulk of the patches used to access a permanent file are placed in an area of TSSO which is reserved for UST space when the UST origin is not adjusted upward (actually, this space was needed in releases prior to W7.2.0 to prevent the generation of a UST for TSR1 from destroying the code at the end of TSS startup; with the TSS INIT file feature, enough code intervenes so that this buffer is not necessary and so that the UST origin can be moved up and not destroy the code). The first transfer into these patches is at offset 4673 in TSSO (symbolic offset DMYERR+2, instruction EAX5 1). Here, the USERID in the file structure defined in the patches is stored into the SSA of TSS at location .SUID. Then a MME GEMORE accesses the file. Use of .SUID makes FMS think that the file is being accessed by its owner and thus, no special permissions are needed. If the MME GEMORE is denied, a flag is set to 0 before control returns to the original TSSO coding from offset 2013 in the patches.

The second transfer, at octal offset 5572 (symbolic location IN7630+3) replaces the instruction defining the UST origin. The patch at octal offset 5271 remains intact. In the second group of patches, the

permanent file must be released, the number of PATs decremented by one, and the USERID in .SUID set to zero. If the GEMORE in the first set of patches is denied, then the number of PATs is not decremented. This alteration of word .SNPAT in the SSA is necessary because releasing the file does not remove the file code from the SSA. The patch for defining the new UST origin is moved to octal offset 2031 in the patches, just before a transfer back to TSSO.

5.2.10.4 Production Use of the Monitor. The following steps must be taken to enable data capture:

1. Append patches on file B29IDPXO/GMFCOL/TSS/TSS.PAT to Timesharing INIT File (normally OPNSUTIL/TS1).

2. Run the file B29IDPXO/GMFCOL/TSS/TSGMF to create the new TSS subsystem file.

3. Start TS1.

4. Start a copy of GMC with the TSS Monitor active.

5. Log on to a master USERID and enter "SYST GMF" at the "*" prompt following log-on to install the hooks into TSS code. Traces will not start at this time. The master USERIDs assembled in TSS are MASA and MASB. Unless these are patched or redefined in the TSS INIT file, only a terminal ID designated as master in .MSECR may be used for this step

6. Enter "TS1 TRACE ON" from the system console to start generation of traces from TSS.

7. Enter "TS1 TRACE OFF" from the system console to suspend generation of traces.

Steps (5), (6) and (7) execute independently of (4); however, use of step (6) without use of step (4) will cause unnecessary TSS overhead if traces are being generated and lost due to GMC not being in execution. Steps (6) and (7) may be repeated multiple times if traces are to be captured for specific periods of the day. (The companion data reduction program, described in section 15 (not yet published) cannot process GMC sessions longer than 9 hours).

5.2.10.5 Monitor Limitations. To obviate lockup fault, initial trace generation (at "TS1 TRACE ON", and following lost data) is inhibited until the number of TSS users falls below 50. Further, all trace generation is inhibited until the number of users falls below 100. (The companion data reduction program is limited, by parameter, to 50 active USTs).

5.3 Processing

The GMC requires one tape drive, 15K-24K words of storage, and, if the multireel option will be used, 300 links of disk storage to execute. The actual memory required will depend on the number of monitors selected for execution. The GMC will lock itself into memory, assuring that it cannot be swapped or moved during the run time. An initialization procedure will attempt to relocate GMC out of the memory growth range of Time-Sharing (TS1) and, in addition, relocate GMC to the high or low end of a quadrant of memory. Due to this

feature, GMC can be started at any time of the day, without fear of causing memory fragmentation or degraded TSS response.

Immediately prior to beginning collection of data, GMC will attempt to relocate out of the TSS (TS1) memory growth range. On a system with more than 256K of memory, the growth range of TSS (TS1) is assumed to be 180K, while on a system with less than 256K of memory the growth range is considered to be 100K. During this relocation procedure GMC might grow in size; however, the user need not be concerned, since GMC will release all unneeded memory after the relocation operation is completed. If GMC cannot relocate out of the growth range of TSS (TS1), the GMC will abort with a CM abort. The user can override this abort with a data card option, but he should do so with great care since TSS response might be severely degraded if GMC prevents TSS (TS1) from growing in size. The procedures for overriding the abort can be found in subsection 5.5.4.

After GMC succeeds in relocating out of the growth range of Time-Sharing, GMC will attempt to relocate itself to the high or low end of the memory quadrant. It will relocate as far away as it can, but it will not abort if it is unsuccessful. Therefore, slight memory fragmentation is still possible, but this should cause little if any problem to the operation of the computer.

5.3.1 Executive Routine. The Executive Routine (ER) controls the processing of the GMC. The ER controls all inputs, outputs, start and stop time, and all required error processing. The ER also hooks the GMC into the dispatcher.

The ER begins processing by reading the input parameters on the data card. The procedure for determining the required data card parameters for GMC operation is fully described in subsection 5.5. Using these parameters, ER determines which monitors will be active during the run. If a start time is specified, ER will remain idle until the start time is reached. During this time, it is possible that GMC will be swapped. The ER will cause the GMC to terminate at a specified stop time if the option is present. Multireel output is the standard default for GMC; however, the user can request GMC to terminate after one or more reels of data have been collected. The ER controls all error aborts within GMC. Abort codes and reasons for the abort are shown in table 5-2. When ER begins processing, it will query the operator for the first tape number with the message:

*FOR XXXXX WHAT IS THE MOUNTED TAPE'S NUMBER?

where XXXXX is the SNUMB assigned GMC. The operator must enter the reel number of the tape to be used for GMC output. If the operator

Whenever the dispatcher executes a trace after this point, the GMC ER will gain control and pass the system control over to the proper monitor for data collection. Control is then returned to the ER for return to the dispatcher.

In the process of collecting data, a monitor may desire to save a logical record on the collection tape. In order to sequence all logical records to the tape file, a common buffering system has been provided by the GMC. Any monitor can pass control to symbol BUFCTL for buffering a logical record to be saved on the tape file. This code is executed in master mode as an extension of the operating system function where control has been taken. Writing the buffered data to tape is a GMC slave function which requires controls between the buffering system and the writing system. The buffering system indicates, via software to the slave, when an individual buffer is to be written. After the slave has written the buffer, it is returned to the buffering system. The slave code for writing the tape is started at symbol BUFCHK. This slave portion is normally in GEWAKE mode and is awakened either by GMC master mode code or by a normal dispatch. The slave function will check for a full buffer and write it before going back to sleep. This process is repeated until GMC has been terminated, at which time the slave portion will execute the proper abort code via a MME GEBORT. The wrap-up procedure then performs all termination requirements. GMC will terminate via direction from the time option on the data card, limited reel option on the data card or else via console command. If no time option or limited reel option has been selected, the GMC will continue to process until it is ABORTED via the console.

At termination, the wrap-up location is given control and the termination record is processed. This is the slave termination of GMC. Also associated with termination is the return of the dispatcher code to its original state. This is accomplished by GMC checking its own .STATE word for a termination code. When the termination code is sensed, the dispatcher hook is removed, the original code is replaced, and the slave termination process is completed. Upon termination, ER reads the communication region table, writes the data to tape with a termination record, removes any patches it has placed in the system, and proceeds to wrap up.

5.3.2 Output. Output of GMC is always a magnetic tape file. The following is a guideline for the number of tapes generated by each monitor (800 BPI, 2400 feet tape reels):

- MUM - one tape every 6-8 hours. With Idle Monitor, one tape every 3 hours.
- MSM - one tape every hour

CPUM - 1 tape every 24 hours
TM - 1 tape every 24 hours
CM - 1 tape every half hour
TPSM - 1 tape every 4 hours
CAM - 1 tape every 8 hours
GRTM - 1 tape every 24 hours
TSSM - 1 tape every 2 hours

Analysis of this tape(s) is accomplished by a series of dedicated data reduction programs which are discussed in sections 6 through 12 and section 15 (not yet published). It is essential that the proper data reduction program is run against data created by its associated monitor routine.

The GMC is usually terminated by operator request. However, there are times when the monitor may terminate itself. In most of these cases, the operator will receive a console message indicating the reason for the abort (see table 5-2). However, under some circumstances the message the operator sees is that GMC terminated with "NO REASON SPECIFIED." In this case, if the job listing is examined, a reason will be given under the WRAPUP activity information as shown below.

```
* ACTY-01 $ CARD #0008* GELOAD  03/16/78  SW=000000000000
NO REASON SPECIFIED        AT 030440 I=5060 SW=000000000000

*WRAPUP BEGUN
(USERS BS MME GEBORT)      AT 031413 I=0000 SW=000000000000
```

5.4 GMC Data Records

5.4.1 GMC Executive. The GMC Executive produces an initialization record that must be read by every data reduction program. This record contains information on the system configuration and the status of various queues at the time the monitor started. The length of the record is dependent on the size of the configuration. The Executive also writes a termination record whenever it terminates normally.

Initialization Record

Word	Bits	Information
1	0-35	Block Control
2	0-35	Zero
3	0-17	Year (.CRJCD)
	18-35	Julian day (.CRJCD)
4	Not used	
5	0-35	Current date (.CRDAT)
6	0-35	Current time (.CRTOD)
7	0-35	Reg A of RSCR 32

The following information is dependent on job status (bits 25-27 of word 1)

Job Status	Information Collected
0	No data follows
1	New memory address
2	Snumb and activity
3	Snumb, activity, new address
4	10 ident words, 2 userid words
5	Ident, userid, new address
6	Ident, userid,snumb, activity
7	Ident, userid, snumb, activity, address

The Memory address word contains the following:

0-17	MBA in 512 word blocks
18-26	LAL in 512 word blocks
27-35	Not used

The Activity word contains the following:

0-8	Not used
9-17	Activity number
18-35	Not used

All multiple word entries contain the following three words:

Current CPU time
Current I/O Time
Memory Use Word

The Memory Use Word contains the following:

0-17	Memory used
18-29	Termination Code
30-35	Job Urgency from .SURG of a job

At the end of all T10 records the following two words will appear:

0-35	Number of 512-word blocks Available (word 0, .CRPMU table)
0-35	RSCR Time

If a RLSEC request is delayed (e.g. a request to release memory in which TSS is loaded must wait until TSS is swapped), then the number of blocks available may include nonallocatable memory (that portion of the RLSEC beyond the size of TSS). A delayed RLSEC request may be

indicated by consecutive MUM records which show no changes in memory(the MUM writes its record every time that .MPQ04 is called; in a delayed RLSEC request, .MPQ04 takes its denial exit without changing the memory state).

5.4.2.2 Trace Type 46. This GCOS system trace is generated every time a job is given a program number and results in a trace type 46 MUM record being generated. The format of the GMC trace type 46 record is shown below.

Word	Bits	Information
1	0-17	Size of record (=3)
	18-26	Not used
	27-35	Octal 46 (trace number)
2	0-29	SNUMB
	30-35	Octal 46
3	0-11	Not used
	12-17	Program number
	18-35	Not used
4	0-35	Time stamp

5.4.3 MSM. The MSM processes GCOS system trace types 7 and 15 by creating its own data collection records to describe the effect of these events. It also processes the specially-generated GMC trace events 73 and 76.

5.4.3.1 Trace Type 7. This GCOS system trace is generated every time a connect is issued and will result in the generation of a GMC trace type 7 record. The format of the GMC trace type 7 record is shown below.

Word	Bits	Information
1	0-17	Size of record (normal = 14, special = 21)
	18-23	Special file code description flags
	18	Permanent (=0), temporary (=1)
	19	Random (=0), sequential (=1)
	20	Not catalogued (=0), catalogued (=1)
	21	Removable (=0), fixed (=1)
	22	Flag (=1 - TSS user file (no file code))
	23	Flag (=1 - SCF File I/O (trace 22 is missing))
	24-26	Processor #
	27-35	Octal 7 (trace number)
2	0-17	I/O's word count
	18-23	Program number
	24-35	File code
3	0-35	System controller time of day

processed: 2, 3, 4, 5, 8, 9, 10, 11, 18, 19, 20, 22, 23, 27, 28, and 29. The format of the GMC record generated is as follows:

Word	Bits	Information
1	0-17	Size of record (variable)
	18-26	Not used
	27-35	Octal 15 (trace number)
2	0-35	-1 if program generating this record is not PALC. Otherwise this word contains a file code in bits 18-35.
3	0-35	-1 if program generating this record is not PALC. Otherwise it contains the SNUMB of the job for which PALC is working.
4	0-17	GEFSYE type
	18-20	Processor #
	21-26	Program #
	27-35	Activity #
5-n	0-35	Catalog file string name - not to exceed 40 words.

In order to monitor the catalog file string names of user files that are being processed by the File Transfer System (FTS), it is necessary to capture the occurrence of a MME GEMORE when issued by FTS. All MME GEFSYEs issued by FTS are ignored so as not to cause a conflict with the MME GEMOREs. An FTS GEMORE is processed only if it is a GEMORE for a permanent file. The record generated is identical to the MME GEFSYE record, except that word 2 is a minus one (-1) and word 3 is the file code being used by FTS.

5.4.3.5 <u>FMS Cache Record.</u> During the execution of MSM or CM a special record is written at preselected times during the monitoring session. These records are used to analyze FMS catalog cache (when configured) and also the effectiveness of the incore space tables for disk devices. This record is not generated on a WW6.4 system. The format of this GMC record is shown below.

Word	Bits	Information
1	0-17	Size of record (=15)
	18-26	Not used
	27-35	Octal 77 (special flag)
2	0-35	Number of cache hits (word -12 from entry point of .MFSIO)
3	0-35	Number of writes (word -11 from entry point of .MFSIO)
4	0-35	Number of reads (word-10 from

		entry point of .MFSIO)
5	0-35	Number of reads not in CC (octal 1511 from entry point of .MFSIO)
6	0-35	Number of non-320 word reads (octal 1512 from entry point of .MFSIO)
7	0-35	Number of skips caused by .SSTAK (octal 1513 from entry point of .MFSIO)
8	0-35	Number of cache clears (octal 1514 from entry point of .MFSIO)

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9	0-35	Number of no hits (octal 1520 from entry point of .MFSIO)
10	0-35	Number of hits (octal 1521 from entry point of .MFSIO)
11	0-35	.CRSHR
12	0-35	Number of times buffer allocation attempted (word -6 from entry point of .MAS04)
13	0-35	Number of times buffer busy (word -5 from entry point of .MAS04)
14	0-35	Number of times available space table was already in memory (word -4 from entry point of .MAS04)
15	0-35	Number of times available space table was in memory but was busy (word -3 from entry point of .MAS04)

5.4.4 CPUM. The CPU Monitor processes the GMC generated event trace type 70.

5.4.4.1 Trace Type 70 - Standard. This GMC record allows six processors to be monitored and allows differentiation between TS1 executive processor time and TS1 subdispatch processor time. If an activity has a program number greater than 14 or FSTSLV, it is considered as a system program if: it is privileged (bit 18 of the .STATE is set) and if it has no J* file for SYSOUT (.SGNPA). This extension of the definition for system programs allows accumulation of processor time used primarily by copies of GEIN. Although DRL TASK jobs have no J* file, they are considered user activities because they are not privileged (the CPU monitor will accumulate processor time associated with termination of DRL TASK jobs as system CPU time since, when terminating, DRL TASK activities are privileged). An activity is recognized as a copy of TSS if bit 13 in its .STAT1 word is set and if its SNUMB is TS2, TS3, or TS4 (TS1 always has program number 5). The check on the .STAT1 word eliminates possible confusion between legitimate copies of TSS and GEIN execution of spawn files or termination of DRL TASK jobs by the same names. If a system program has a SNUMB of $PACT, $MOLT, $POLT, $COLT, $SOLT, or $SLTA its processor time is accumulated, along with that for program number six (test and diagnostics). If a system program described above performs an initialization before it puts its SNUMB into .CRSNB, its processor time may be accumulated in the special category for miscellaneous system programs. The format for this GMC trace type record is shown below.

Word	Bits	Information
1	0-17	Size of record (77 or 83)
	18-26	Not used
	27-35	Trace number (octal 70)

writing of a GMC trace type 14 record. The format for this GMC trace type 14 record is shown below.

Word	Bits	Information
1	0-17	Record size (=variable)
	18-26	Not used
	27-35	Octal 14 (trace number)
2	0-35	Time stamp
3	0-2	355 number
	3-17	Logical line number
	18-35	Terminal ID
4	0-8	Terminal type
	9-17	ICM count
	18-26	OP code
	27-35	Command
5-7	0-23	ICM Data
8	0-23	Not used
	24-35	Data tally
9	0-11	Ignore
	12-17	Status
	18-29	Input data tally
	30-35	Not used
10	0-17	Slave LAL
	18-35	Checksum
11-12	0-17	Number datanets
	18-35	Not used
13-n	0-35	A series of values will follow depending upon the number of datanets configured. The values collected are the number of special interrupts processed, number of special interrupts unanswered, number of requests waiting mailbox. For each type of entry, a single value will appear for each datanet configured. This set of numbers will then be followed by the second table type and finally the third table type. This series of tables is next followed by a fourth table containing the number of lines waiting mailbox over each datanet.
n+1	0-35	Userid or -1 if not logged on to TSS
n+2	0-35	Userid
n+3	0-17	Not used
	18-35	TSS flags (.LFLAG)
n+4	0-17	Not used
	18-35	Subsystem size (words) (.LSIZE)
n+5-529	0-35	Communications traffic (only if specific CAM option specified)

present only if user logged onto TSS

5.4.7.2 Special Trace Type 14. This trace record is written during CAM initialization to specify the start time. Its structure is shown below.

Word	Bits	Information
1	0-35	Octal 7000014
2	0-35	Time from MME GETIME
3-8	0-35	Not used

5.4.7.3 Special TSS Trace Type 14. This trace record is written a single time and provides a description of the Timesharing Environment as it exists during this data collection period.

Word	Bits	Information
1	0-17	Record size (=30)
	18-26	Not used
	27-35	Octal 14 (trace number)
2	0-35	special flag (= -2)
3	0-35	.TFMAX - maximum number terminals
4	0-35	.TAMRI - time interval for memory size reduction
5	0-35	.TATMC - maximum time allowed for size changes
6	0-35	.TAGMI - minimum time between GEMORE requests
7	0-35	.TAMMS - initial maximum TSS size
8	0-35	.TASMS - minimum TSS size
9	0-35	.TAMII - memory size growth factor
10	0-35	.TASRI - memory size reduction factor
11	0-35	.TSFS - minimum size reduction factor
12	0-35	.TSGRW - minimum swap file size
13	0-35	.TSSF - number of swap files
14	0-35	.TCSF - swap file #S
15	0-35	.TCSF+1 - swap file #T
16	0-35	.TCSF+2 - swap file #U
17	0-35	.TCSF+3 - swap file #V
18	0-35	.TIMER - reconnect timer
19	0-35	.TAMIS - large subsystem fence size
20	0-35	.TALPP - large subsystem wait time
21	0-17	.TAGPP - #32 ms time quantums
	18-35	.TAGPP - frequency of Priority B dispatching with a 1 meaning every other dispatch and a 2 meaning every third dispatch
22	0-35	.TTASK - maximum number of concurrent derail tasks
23-31	0-35	.TSFDV-.TSFDV+8 - device allocation for TSS files #D, #P, #Q, .D, SS, #S, #T, #U and #V

5.4.7.4 Special GEROUT Trace Type 14. This trace record is written whenever a user transfers from one major subsystem to another (Example: TS1 to FTS).

Word	Bits	Information
1	0-17	Record size (=7)
	18-26	Not used
	27-35	Octal 14 (trace number)
2	0-35	-3 (flag)
3	0-17	0
	18-23	GEROUT type
	24-35	Terminal ID
4	0-35	New DAC name
5	0-35	Time
6-7	0-35	Not used

5.4.8 GRTM. The GRTS Monitor processes one GMC trace record, type 62.

5.4.8.1 Trace Type 62. This GMC trace is generated whenever the DATANET-355 GRTS Monitor data record is transmitted to the GMC. The format for this GMC trace type 62 record is shown below.

Word	Bits	Information
1	0-17	Record size (variable)
	18-20	DATANET number
	21-26	Not used
	27-35	Octal 62 (trace number)

Word	Bits	Information
2	0-35	Time stamp - H6000
3	0-17	DAC character count
	18-35	Time stamp - DN-355
4	0-17	010101
	18-35	Buffer denials (cumulative)
5	0-17	010201
	18-35	Buffer availability (current)
6	0-17	010301
	18-35	Number of users (current)
7	0-17	010401
	18-35	Number of transactions sent to host (cumulative)
8	0-17	010501
	18-35	Number of transactions received from host (cumulative)
9	0-17	010601
	18-35	Number of 36-bit words sent to host (cumulative)
10	0-17	010701
	18-35	Number of 36-bit words received from the host (cumulative)
11	0-17	011001
	18-35	Number of host RSVPs received (cumulative)
12	0-17	011101
	18-35	Amount of time in milliseconds spent in idle loop since the last buffer was sent
13	0-17	011201
	18-35	Number of calls to the buffer allocation routine (cumulative)
14	0-17	030105
	18-26	HSLA
	27-35	HSLA subchannel
15	0-17	Number of transmits on S/C (cumulative)
	18-35	Number of receives on S/C (cumulative
16-N		Additional entries depending on the number of subchannels specified on the data card.
N+1		Response Time Buffer. This portion of data is variable depending upon the activity occurring on the DN-355. The various types of data that can be collected in this buffer are illustrated below.

5.4.10 TPS. The TPSM processes GCOS system trace types 0, 1, 2, 4, 5, 6, 13, 42, 51, 65 and 74 by creating its own data collection records to describe the effect of these system events.

5.4.10.1 Trace Types 0, 1, 2, 4, 5, 6 and 65. These GCOS system traces are generated during job I/O and execution and result in the generation of a GMC trace type 74 record. The format for this GMC trace type record is shown below.

Word	Bits	Information
1	0-17	Number of words following (record control word)
	18-26	Not used
	27-35	Octal 74 (trace number)
2	0-35	Register A of standard GCOS trace
3	0-35	Register Q of standard GCOS trace
4	0-35	Time Stamp

5.4.10.2 Trace Types 13, 42 and 51. These GCOS system traces are generated for each job start, process, and termination. The TPSM processes these traces for each TPAP and generates the following GMC trace type 74.

Word	Bits	Information
1	0-17	Number of words following (record control word)
	18-26	Not used
	27-35	Octal 74 (trace number)
2	0-35	Register A of standard GCOS trace
3	0-35	TPAP SNUMB
4	0-35	Time Stamp

5.4.10.3 Trace Type 74. This internally generated TPE trace has a variable format depending upon where within TPE the trace was generated.

5.4.11 TSS Monitor. The TSS Monitor (TSSM) collector generates traces by using the GCOS trace 74 mechanism. Since both TPSM and TSSM use the same GCOS trace (74), they are incompatible.

5.4.11.1 TSSM Trace Type 74. Formats of the TSSM trace 74 vary according to the subtype; there are 105 subtypes.

Except where noted, all traces written by TSSM are four words long. The first two words are always in the following format:

Word 1	Bits	0-17	Number of words following (normally 3)
		18-20	Processor number
		21	Flag (=1, TSS in courtesy call)
		22-35	GMC record type (=74 octal)
2		0-35	RSCR time

TSSM normally stores the A-register of GCOS trace 74 into word 3 and the Q-register of GCOS trace 74 into word 4. There are three exceptions to this rule. For the I/O request trace (24), TSSM adjusts the I/O queue address passed by TSS from a negative offset to a positive offset using the Lower Address Limit. The second exception is that the TSSM detected delay trace (105) is created during parallel CPU monitor processing so that if TSS receives no dispatches, a trace can be made anyway to give SSA data about TSS. The last exception is for the initialization trace (90). For this trace, receipt of GCOS trace 74 tells the TSSM capture routine to produce a series of special records. The only other trace subtype having a length other than four words is subtype 32. In that subtype, two words are appended onto the normal four-word format. Word 3 takes the following format in most traces:

Word 3	Bits	0-17	UST address
		18-20	Flags or program stack (usually zero)
		21-29	Subtype number
		30-35	GCOS trace number (=74 octal)

The above format will be called "Common format" in following trace descriptions when the flag field is zero.

Subtype 1, Log-on complete

Word 3		Common format
4	0-23	Reserved (DRUN ID in trace 32)
	24-35	Line ID or blanks (BCD)

Subtype 2, Swap space denied

Word 3	Common format
4	Not used

Subtype 3, PAT denial

Word 3 Common format

4 Bits 0-17 Not used
18-35 Flag (=0, no PAT, |0, duplicate file)

Subtype 4, GEFSYE deallocate

Word 3 Common format
4 Not used

Subtype 5, GEFSYE deallocate complete

Word 3 Common format
4 Bits 0-17 Not used
18-35 FMS status

Subtype 6, Print error message

Word 3 Common format

4 Bits 0-17 Not used
18-35 Error code (range 1 to 64)
See DD17C pg. 3-3.1, 3-3.2

Subtype 7, POPUP primitive

Word 3 Bits 0-17 UST address
18-20 Program stack tally (=6 - depth, see notes)
21-29 Subtype
30-35 GCOS trace type (=74 octal)

4 Bits 0-35 Subsystem name (ASCII)

The above format is also used in subtypes 8, 10, and 85.

Subtype 8, CALLP primitive

Words 3 and 4 Same format as in subtype 7

Subtype 9, Enter build mode

Word 3 Common format, bits 18-20 are program stack tally
4 Not used

Subtype 10, EXEC primitive

    Words 3 and 4 Same format as in subtype 7

Subtype 11, SYSTM primitive

    Word 3 Common format
         4 Not used

Subtype 12, Log-off

    Word 3 Common format
         4 Not used

Subtype 13, Command received

    Word 3 Common format
         4 Bits 0-35 Command text (ASCII)

Subtype 14, Periodic check

    Word 3 Bits 0-20 Not used
                 21-29 Subtype (=14)
                 30-35 Trace type (=74 octal)

         4   0-23 Not used
                 24-35 Line ID if new user waiting

Subtype 15, GEWAKE - no users

    Word 3 Bits 0-20 Not used
                 21-29 Subtype (=15)
                 30-35 Trace type (=74 octal)

         4   0-35 GEWAKE interval (clock pulses)

Subtype 16, Break or disconnect

    Word 3 Common format
         4 Bits 0-35 GEROUT status (=1, break; =2, disconnect)

Subtype 17, GEWAKE until subdispatch done

```
     Word 3  Bits  0-20 Not used
                  21-29 Subtype (=17)
                  30-35 Trace type (=74 octal)

          4        0-35 GEWAKE interval (clock pulses)
```

Subtype 18, GEWAKE with subdispatch busy

```
     Word 3  Bits  0-20 Not used
                  21-29 Subtype (=18)
                  30-35 Trace type (=74 octal)

          4        0-35 GEWAKE interval (clock pulses)
```

Subtype 19, All Points Bulletin or remote I/O courtesy call

```
     Word 3  Common format

          4  Bits  0-17 Contents of .LFLG2
                  18-35 GEROUT status
```

Subtype 20, Build mode input received

```
     Word 3  Common format

          4  Bits  0-17 Contents of .LFLG2
                  18-35 GEROUT status
```

Subtype 21, SY** I/O complete

```
     Word 3  Common format
          4  Not used
```

Subtype 22, Place user in reconnect mode

```
     Word 3  Common format

          4  Bits  0-18 Not used
                  19    Flag (=1, data in transmission)
                  20-35 Not used
```

Subtype 23, Process DRL

Word	3	Bits	0-17	UST address
			18	Flag (=1, data transmission interrupted)
			19	Flag (=1, terminal I/O in transmission)
			20	Not used
			21-29	Subtype (=23)
			30-35	Trace type (=74 octal)
	4		0-17	DRL number
			18-35	Instruction counter

Subtype 24, Request file I/O

Word	3	Bits	0-17	UST address
			18	Flag (=1, user will be charged for this I/O)
			19	Flag (=1, trace made at courtesy call level)
			20	Flag (=1, actual return address stored in trace)
			21-29	Subtype (=24)
			30-35	Trace type (=74 octal)
	4		0-17	Variable, based on flag bits Zero if bit 18=1 Number of module to which control will return if bit 20=0 (TSSB=2, TSSC=3, ..., TSSN=14) Return address loaded from TSSK if bit 20=1 (indicates error in finding module number)
			18-35	I/O queue address (SSA negative offset) Note: Flag bits 19 and 20 are not used if bit 18 is set on.

Subtype 25, Disk I/O complete

Word 3 Common format
4 Not used

Subtype 26, Denial from DRL DEFIL

Word 3 Common format

4 Bits 0-35 Denial code
3 AFT full

4 Temporary file not available
5 Duplicate file name
6 No PATs available
7 Illegal device type

Subtype 27, Issue MME GEFSYE

```
Word 3  Common format
     4  Bits  0-17 FMS function code
             18-35 Not used
```

Subtype 28, GEFSYE denied - bad FILACT parameter

```
Word 3  Common format

     4  Bits  0-17 Not used
             18-35 Status code (see DD17B, pg. 38)
```

Subtype 29, Courtesy call from trace 27

```
Word 3  Common format

     4  Bits  0-17 Not used
             18-35 FMS status
```

Subtype 30, DRL delayed 200 ms.

```
Word 3  Common format
     4  Not used
```

Subtype 31, DRL delayed 2 seconds with DRL GWAKE

```
Word 3  Common format
     4  Not used
```

Subtype 32, Store USERID in UST (two extra words added by GMC)

```
Word 1  Bits  0-17 Number of words following (=5)
             18-35 GMC record type (=74 octal)

     2        0-35 RSCR time

     3        0-35 Common format
```

```
        4       0-29 DRUN ID (BCD) or zero
               30-35 Not used

      5-6  0-35 USERID from UST
```

Subtype 33, SY** I/O (PASUST, code -1) complete

```
     Word 3  Common format
          4  Not used
```

Subtype 34, DRL MORLNK error

```
     Word 3  Common format

          4  Bits  0-17 Not used
                  18-35 Error code (octal)
                        400000 PAT full
                        200000 Link space exhausted
                        100000 File is permanent
                        040000 File not in AFT
                        020000 No links requested
```

Subtype 35, I/O for DRL SPAWN or PASFLR complete

```
     Word 3  Common format
          4  Not used
```

Subtype 36, Batch job submitted

```
     Word 3  Bits  0-17 UST address
                  18    Flag (=1, wait until job complete)
                  19-20 Not used
                  21-29 Subtype (=36)
                  30-35 Trace type (=74 octal)

          4        0-35 SNUMB
```

Subtype 37, Error in DRL SPAWN

```
     Word 3  Common format

          4  Bits  0-17 Error code (some not reported)
                        1 Undefined file
                        2 No PAT
                        3 Duplicate SNUMB
```

4 SNUMB not given
5 No program number available
6 System scheduler queue full
18-35 Not used

Subtype 38, Enter routine to write dump to ABRT

Word 3 Common format
4 Not used

Subtype 39, ABRT file I/O complete

Word 3 Common format
4 Not used

Subtype 40, Increment number of executions of subsystem - DRL RESTOR

Word 3 Common format

4 Bits 0-35 Subsystem name (ASCII)

Subtype 41, Load subsystem with DRL RESTOR

Word 3 Common format
4 Not used

Subtype 42, Subsystem load complete

Word 3 Common format
4 Not used

Subtype 43, Permanent file I/O from DRL RESTOR complete

Word 3 Common format
4 Not used

Subtype 44, Start line switch

Word 3 Bits 0-17 UST address
18 Flag (=1, wait until switch complete)
19-20 Not used
21-29 Subtype (=44)
30-35 Trace type (=74 octal)

4 0-35 BCD inquiry name

Subtype 45, Call .MFS19 for file grow

Word 3 Common format
4 Not used

Subtype 46, File grow complete

Word 3 Common format
4 Bits 0-17 Not used
18-35 FMS status

Subtype 47, Start console I/O for DRL CONSOL

Word 3 Common format
4 Not used

Subtype 48, Return from DRL JOUT (not always reported)

Word 3 Common format

4 Bits 0-17 Status
-1 Batch system full
0 Normal
1 Lost PAT
|1 Job status if executing
18-35 Not used

Subtype 49, Output busy status from DRL JOUT (not always reported)

Word 3 Common format
4 Not used

Subtype 50, Start DRL GWAKE

Word 3 Common format

4 Bits 0-17 Not used
18-35 Time in seconds

Subtype 51, I/O for *J write for DRL TASK complete

Word 3 Common format

4 Not used

Subtype 52, Start DRL TASK

Word 3 Common format

4 Bits 0-35 SNUMB

Subtype 53, I/O for *J read for DRL TASK complete

Word 3 Common format
4 Not used

Subtype 54, I/O for DRL SAVE complete

Word 3 Common format
4 Not used

Subtype 55, Call .MFS13 for IDS attributes

Word 3 Common format
4 Not used

Subtype 56, Status from IDS attributes

Word 3 Common format

4 Bits 0-17 Not used
18-35 FMS status

Subtype 57, Denial from DRL T.SYOT

Word 3 Common format

4 Bits 0-35 Code
1 System temporarily loaded
2 Function number invalid
3 File not in AFT
4 File not temporary
5 SYSOUT backdoor file not configured

Subtype 58, UST address switch with DRL T.CONN

```
     Word 3  Bits  0-17 Old UST address
                  18-20 Not used
                  21-29 Subtype (=58)
                  30-35 Trace type (=74 octal)

          4        0-17 Not used
                  18-35 New UST address
```

Subtype 59, Disk I/O for tape mode complete

```
     Word 3  Common format
          4  Not used
```

Subtype 60, Allocator services

```
     Word 3  Common format

          4  Bits  0-17 Function code
                        0 New task in memory allocation
                        1 Error
                        2 Turn on file I/O roadblock
                        3 Turn off file I/O roadblock
                        4 Start non-TSS process
                        5 Terminate non-TSS process
                        6 Add memory to subsystem
                        7 Release subsystem memory
                  18-35 Contents of .LFLAG
```

Subtype 61, Enter processor allocation

```
     Word 3  Bits  0-17 Last UST address or random data
                  18-20 Not used
                  21-29 Subtype (=61)
                  30-35 Trace type (=74 octal)

          4  Not used
```

Subtype 62, Enter memory allocation

```
     Word 3  Bits  0-20 Not used
                  21-29 Subtype (=62)
                  30-35 Trace type (=74 octal)
```

```
        4        0    Flag (=1, no urgent user present)
                 1-19 Not used
                20    Flag (=1, fence up too long)
                21-35 Not used
```

Subtype 63, Enter swap decision processing

```
    Word 3  Bits  0-20 Not used
                 21-29 Subtype (=63)
                 30-35 Trace type (=74 octal)

         4  Not used
```

Subtype 64, Interpret next primitive

```
    Word 3  Common format, bits 18-20 are program stack tally

         4  Bits  0    Flag (=1, special processing for 40 file AFT)
                  1-17 Not used (indicator register)
                 18-29 Not used (fields in primitives)
                 30-35 Primitive type
                        1 CALLP
                        2 EXEC
                        3 BIN
                        4 POPUP
                        5 RETURN
                        6 XCALL
                        7 SYSTM
                        8 IFALSE
                        9 IFTRUE
                       10 STFALS
                       11 STRUE
```

Subtype 65, Consider TSS size increase

```
    Word 3  Bits  0-20 Not used
                 21-29 Subtype (=65)
                 30-35 Trace type (=74 octal)

         4        0-19 Not used
                 20    Flag (=1, do consider increase)
                 21-35 Not used
```

Subtype 66, Initiate size increase for urgent user

Word 3 Common format

4 Bits 0-17 Not used
18-35 New TSS size (words)

Subtype 67, Set up fence for urgent user

Word 3 Common format
4 Not used

Subtype 68, Set up urgent user class memory reserve

Word 3 Common format

4 Bits 0-17 Size of user class memory reserve
18-35 Not used

Subtype 69, Force swap

Word 3 Bits 0-17 UST which is to be force swapped
18-20 Not used
21-29 Subtype (=69)
30-35 Trace type (=74 octal)

4 Not used

Subtype 70, Terminate swap process

Word 3 Bits 0-17 UST which could not be force swapped
18-20 Not used
21-29 Subtype (=70)
30-35 Trace type (=74 octal)

4 Not used

Subtype 71, UST area increase by 1K

Word 3 Bits 0-20 Not used
21-29 Subtype (=71)
30-35 Trace type (=74 octal)

4 Not used

Subtype 72, Issue GEMORE for memory

```
Word 3  Bits  0-20 Not used
             21-29 Subtype (=72)
             30-35 Trace type (=74 octal)

     4        0-35 Number of K words requested
```

Subtype 73, GEMORE successful

```
Word 3  Bits  0-20 Not used
             21-29 Subtype (=73)
             30-35 Trace type (=74 octal)

     4        0-35 Number of 512-word blocks added
```

Subtype 74, Memory release

```
Word 3  Bits  0-20 Not used
             21-29 Subtype (=74)
             30-35 Trace type (=74 octal)

     4        0-35 Number of words released
```

Subtype 75, GEMORE refused or reduction not possible

```
Word 3  Bits  0-20 Not used
             21-29 Subtype (=75)
             30-35 Trace type (=74 octal)

     4  Not used
```

Subtype 76, Cancel CRUN mode

```
Word 3  Common format

     4  Bits  0-17 Flags (.LFLG2)
             18-35 Not used
```

Subtype 77, Attempt memory allocation

```
Word 3  Common format

     4  Bits  0-17 Not used
             18-35 Program size
```

Subtype 78, Memory map change

    Word 3 Common format

         4 Bits 0-8 Subsystem LAL (512 word blocks)
                  9-17 Subsystem size (512 word blocks)
                 18-26 Not used
                 27-35 Extra buffer memory LAL if present

Subtype 79, Swap user program

    Word 3 Common format
         4 Bits 0-17 Program size
                 18-35 Not used

Subtype 80, Change time types

    Word 3 Common format

         4 Bits 0-17 New time type (range 61-66 for non-useful memory residence time, swap/load time, useful memory residence time, out of memory time, waiting for normal memory allocation time, waiting memory allocation after forced swap time)
                 18-35 Old time type or -1 if no checking available

Subtype 81, Request extra buffer memory

    Word 3 Common format
         4 Not used

Subtype 82, Scan command list

    Word 3 Common format

         4 Bits 0-35 Command (ASCII)

Subtype 83, EBM refused

    Word 3 Common format

         4 Bits 0-19 Not used
                 20   Flag (=1, no memory available)
                 21   Flag (=1, buffer full)
                 22-35 Not used

Subtype 84, Terminal input complete

Word 3 Common format

4 Bits 0-17 Contents of .LFLG2
18-35 GEROUT status

Subtype 85, POPUP to subsystem which issued DRL CALLSS

Words 3 and 4 Same format as in trace 7

Subtype 86, All points bulletin complete

Word 3 Common format
4 Bits 0-17 Contents of .LFLG2
18-35 GEROUT status

Subtype 87, Terminal I/O complete

Word 3 Common format
4 Bits 0-17 Contents of .LFLG2
18-35 GEROUT status

Subtype 88, Remove entry from subdispatch fault queue

Word 3 Common format

4 Bits 0-17 Processor time used, clock pulses
18 Not used
19 Flag (=1, fault, not interrupt, occurred)
20-31 Not used
32-35 Fault type
0 MME
1 Memory
2 Fault tag
3 Command
4 DRL
5 Lockup
6 Zero op code
7 Operation not complete
8 Overflow
9 Divide check
10 Timer runout
11 Parity

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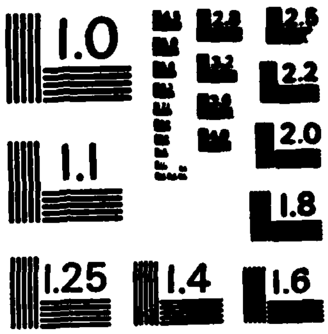
END

FILMED

DTIC



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Subtype 89, Enter routine to process queue

```
     Word 3  Bits  0-20 Not used
                  21-29 Subtype (=89)
                  30-35 Trace type (=74 octal)

          4  Not used
```

Subtype 90, Trace turned off (see note at end)

```
     Word 3  Bits  0-20 Not used
                  21-29 Subtype (=90)
                  30-35 Trace type (=74 octal)

          4        0-35 Flag (=0, TS1 TRACE OFF just executed)
```

Subtype 91, Make subdispatch entry

```
     Word 3  Common format
          4  Not used
```

Subtype 92, Process log-on request

```
     Word 3  Bits  0-20 Not used
                  21-29 Subtype (=92)
                  30-35 Trace type (=74 octal)

          4        0-14 Not used
                  15    Flag (=1, TS1 is aborting)
                  16    Not used
                  17    Flag (=1, TS1 NONEW in effect)
                  18-23 Not used
                  24-35 Line ID (octal 2020 if deferred)
```

Subtype 93, Reject user - bad line status

```
     Word 3  Bits  0-20 Not used
                  21-29 Subtype (=93)
                  30-35 Trace type (=74 octal)

          4        0-23 Not used
                  24-35 Line ID
```

Subtype 94, Check for VIP as terminal type

```
Word 3  Bits  0-5  Terminal type
              6-11 Line ID
             12-20 Not used
             21-29 Subtype (=94)
             30-35 Trace type (=74 octal)

     4        0-17 Number of VIPs allowed
             18-35 Number of VIPs logged on
```

Subtype 95, Check UST wait time

```
Word 3  Bits  0-1  Not used
              2    Flag (=1, cannot assign UST within 16 seconds)
              3-20 Not used
             21-29 Subtype (=95)
             30-35 Trace type (=74 octal)

     4        0-23 Not used
             24-35 Line ID
```

Subtype 96, Reject user

```
Word 3  Bits  0-20 Not used
             21-29 Subtype (=96)
             30-35 Trace type (=74 octal)

     4        0-23 Not used
             24-35 Line ID
```

Subtype 97, UST compression

```
Word 3  Common format

     4  Bits  0-17 Not used
             18-35 New UST address
```

Subtype 98, UST area increase by 1K

```
Word 3  Bits  0-20 Not used
             21-29 Subtype (=98)
             30-35 Trace type (=74 octal)

     4  Not used
```

Subtype 99, UST area decrease by 1K

```
Word 3  Bits  0-20 Not used
             21-29 Subtype (=99)
             30-35 Trace type (=74 octal)

     4  Not used
```

Subtype 100, Terminal I/O request

```
Word 3  Common format

     4  Bits  0-17 Flags (.LFLG2)
             18-23 GEROUT code
             24-35 Line ID
```

Subtype 101, Process command file $*$ function

```
Word 3  Common format

     4  Bits  0-35 Function (ASCII)
```

Subtype 102, Issue remote inquiry GEROUT

```
Word 3  Bits  0-20 Not used
             21-29 Subtype (=102)
             30-35 Trace type (=74 octal)

     4  Not used
```

Subtype 103, VIP input complete

```
Word 3  Common format

     4  Bits  0-17 Contents of .LFLG2
             18-35 GEROUT status
```

Subtype 104, DRL processing complete

```
Word 3  Common format

     4  Bits  0-17 DRL number if status code follows
             18-35 A-register from DRL TASK or DRL T.SYOT;
                   Q-register from DRL SPAWN or DRL PASFLR
                   See DD17C for status codes from these
                   instructions
```

Subtype 105, TSSM detected delay

Word 3	Bits	0-17	Outstanding courtesy calls .SCCAL
4		0-35	Processor time used .SPRT
5		0-35	SSA module resident .SNTRY
6		0-17	I/O requests outstanding .SRQCT
		18-35	I/O requests in transmission
7		0-35	Current clock time from .TSTOD
8		0-35	Current instruction counter, indicators
9		0-35	.STATE word
10		0-35	SMC hashes shut .SFSYS

The following points need to be highlighted concerning the above trace formats. The initialization trace (90) has two purposes: to signal GMC to write initialization records if "TS1 TRACE ON" is entered on the console, or to indicate to the data reduction program that no data for current interactions will follow (TS1 TRACE OFF). If the Q-register seen by TSSM contains zero, then the trace is passed without modification, and writing of TSS monitor records is disabled until TSSM receives a trace 90 with the Q-register equal to 1 (that is, the TSS portion of the collector turns itself off and signals TSSM that the traces have been reenabled by passing a special trace type 74 with a nonzero Q-register). TSSM will write initialization records upon receipt of a GCOS trace 74, subtype 90 with a nonzero Q-register or whenever a lost data condition clears. To handle the case of the writing of the initialization records resulting in a lost data condition requiring regeneration of the records, the first of a series of initialization records has flag bit 19 set. The format of initialization traces is as follows:

Word 1	Bits	0-17	Record size (=15, normal or =3, last record)
		18-20	Processor number
		21	Flag for TSS in courtesy call
		22-35	Trace type (=74 octal)
3		0-35	RSCR time
2		0-17	UST address if normal record
		0-8	Size of large subsystem for penalty, last record
		9-17	Penalty factor, last record
		18	Flag (=1, user in build mode)
		19	Flag (=1, first subtype 90 trace of this series)
		20	Not used
		21-29	Subtype (=90)
		30-35	Trace type (=74 octal)

4	0-23	DRUN ID or zero if normal record
	24-35	Line ID or blanks
		or
4	0-17	Starting address of swap area if last record
	18-35	Ending address of swap area

The following words are not be present in the last record.

5-6	0-35	USERID
7-11		Program stack (subsystem names in ASCII)
12	0-8	Base address
	9-17	Subsystem size, 512 word blocks
	18-35	Time type (range 61-66)
13	0-35	Flags (.LFLG2)
14	0-35	Log-on time (clock pulses)
15	0-17	Extra buffer memory address
	18-35	BTOS flags
16	0-17	Current memory demand in words
	18-35	Flags (.LFLAG)

Information sources for the above information are the following:

UST address - first address is in lower half of .TCUST; subsequent addresses are in the lower half of a word at offset .LUSTL from the current UST address

DRUN ID - found at offset .LCJID from current UST address (bits 0-23)

Line ID - found at offset .LBUF from current UST address (bits 24-35)

Swap area addresses - contained in word at .TACOR

USERID - first two words of UST, symbolic offset .LID

Program stack - described by following scheme:

```
(UST+.LFILE) contains ZERO    TALLY,AFTPTR
                TALLY TALLY   *+n,6-n
                      DUP     1,5
                      ZERO    ASCII name, address of
                              primitive
                  n=depth of stack (0-5, 0=no entries)
                  primitive=3 if build mode
```

Flag for build mode - set nonzero if a primitive 3 is found

Subsystem BAR and LAL - found at offset .LSIZE from current UST address (bits 0-17)

Time type - found at offset .LTCW from current UST address (bits 27-35)

Log-on time - found at offset .LTALC from current UST address

Extra buffer memory address - found at offset .LKMS from current UST address (bits 0-17)

BTOS flags - found at offset .LPQF from current UST address (bits 18-35). If bit 18 nonzero, store EBM address in bits 0-17; otherwise ignore .LKMS

Memory demand - found at offset .LSIZE from current UST address (bits 18-35)

Subsystem size for penalty - found at location .TAMIS in TSSA (bits 0-17)

Penalty factor - found at location .TALPP in TSSA (bits 27-35)

5.4.12 Special Records. During the execution of the GMC, it sometimes is necessary to generate special records that describe the occurrence of a special event. Following is a description of these special records.

5.4.12.1 Lost Data Record. If the rate of data collection does not allow GMC to dump its internal buffers to tape or if the system develops a tape malfunction, it is possible for GMC to generate a lost data condition. When this condition occurs, a special trace is

generated in the last good record recorded on tape. The next good trace recorded will be found at the beginning of the next physical record.

Word	Bits	Information
1	0-35	000777200100

5.4.12.2 Termination Record. Upon termination, GMC writes out a special termination record. The format is described in subsection 5.6.1.

5.4.12.3 End-of-Reel Flag. When the multireel option is enabled, GMC writes the following special record header at the end of each tape.

Word	Bits	Information
1	0-35	007773400100
2	0-35	Continuation reel number (BCD)

5.4.12.4 MUM Lost Data. If GMC generates a lost data condition while executing the MUM, the MUM generates a special flag in the header. The format of this flag is described below.

Word	Bits	Information
1	0-17	Record size
	18-35	Octal 200110 (lost data flag)

5.4.12.5 Reconfiguraton Record. The format of this record is described in subsection 5.4.1 under the reconfiguration discussion.

5.5 GMF User Input Parameter Options

The user must start here to define his intended use of the GMC so that he can then determine his JCL and system structure.

User control over GMC is total as a complete parameter capability is provided. A sample data parameter card is shown in figure 5-3.

The GMC functional options are:

(1) Capability to turn off any particular monitor or combination of monitors.

(2) Specifying that collection is to halt after filling 1-9 data tapes. The default is to collect an unlimited number of tapes.

CC	
1	
M0 M3	Turn off Monitor 0 and 3
M1	Turn off Monitor 1
M1 M9	Turn off Monitor 1 and collect only a single reel
M1 *12.36,05.00	Turn off Monitor 1, start collecting data at 12.36, and collect for 5 hours
*,03.00	All Monitors are present on the R* file and are active, collection is to start at once and continue for 3 hours
+CK	All Monitors are present on the R* file, and communication traffic is to be monitored for terminal CK
M1 M4 M93	Turn off Monitors 1 and 4, and collect maximum of three reels of data
M*	Suppress abort if GMC cannot move
#VIDEO,HEALS	All Monitors are present on the R* file, and accumulate processor time in the CPU Monitor for these SNUMBS.
M0 M5 M8 ?1	Turn off monitors 0, 5, and 8. Collect only tape connects with the MSM and CM.

Figure 5-3. Data Card Examples

(3) Requesting complete communication data for 1 or 2 terminal IDs.

(4) Suppressing a GMC abort if it cannot move to an acceptable location.

(5) Specifying up to three SNUMBS to be processed by the CPU Monitor.

(6) Requesting that only tape connects or mass storage connects be collected, but not both. The default is to collect both types.

(7) Declaring the start and stop times of monitoring.

(8) Requesting high density tape be collected.

(9) Specifying that the Mass Store Monitor and/or Channel Monitor are to collect data only for certain jobs.

(10) Specifying that the data card options are continuing on a new card.

(11) Specifying the monitoring requirements for the GRTM.

5.5.1 <u>On/Off Option</u>. This option allows the user to turn off all monitors not required for his purposes. Since the GMC default is to have all monitors turned on, unless specifically turned off, and since the TSS and TPE Monitors are incompatible, the user must have a data card and at least one of these two monitors must be turned off. The code format to turn off a given monitor is:

M0 = Memory Utilization
M1 = Mass Store Monitor
M2 = CPU Monitor
M3 = Tape Monitor
M4 = Channel Monitor
M5 = Communications Monitor
M6 = GRTS Monitor
M7 = TPE Monitor
M8 = Idle Monitor
MA = TSS Monitor
MB-MF = User Developed Monitors

(See section 13 for a discussion of user developed monitors.)

<u>CAUTION</u>: The TPE Monitor and the TSS Monitor are incompatible and cannot be active at the same time.

While it is optional to turn off a monitor, a user must turn off, on the parameter card, any monitor that is not loaded in the compiled R*. Failure to do so will result in an MO-M8,MA abort. The hexadecimal digit following the M represents the monitor that is not present on the R* file, but yet was not turned off on the parameter card. Details for creation of the R* file are given in subsection 5.6.

5.5.2 Tape Selection Option. This option allows the user to specify the number of data collector tapes to be accumulated in a job run.

M9 = One reel of tape
M91 = One reel of tape
M92 = Two reels of tape
M93(4-9) = Specified number of reels

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$:SELECTA:B29IDPXO/GMFCOL/(see below for FILE requirements and options)

REQUIRED	OPTIONAL, WHEN A MONITOR IS USED ALL PROGRAM ELEMENTS OF THE MONITOR MUST BE USED									
GMF.	MUM.	MSM.	CM.	CPU.	TM.	CAM.	GRT.	IDLE	TP	TSS
GMF.TOP	MUM.INIT	MSM.INT	CM.INIT	CPU.INIT	TM.INIT	CAM.INIT	GRT.INIT	IDL.INIT	TP.INIT	TSS.INIT
GMF.MID		MSM.PAT		CPU.PAT		CAM.PAT				
GMF.PATLOOK*1		MSMDOIT		CPUDOIT		CAMDOIT				
GMF.MON		MSM.REMO		CPU.REMO		CAM.REMO				
GMF.BTM	MUM.T10		CM.T04A	CPU.T70	TM.T50	CAM.T14	GRT.T62	IDL.TRCS	TPE200	TSS.CCL
	MUM.T46		CM.T22A				GRT.COL	IDL.T21		
		CM.T07A*2	CM.T07A							

NOTE-1 GMF.PATLOOK is required only with MSM, CPU and CAM.
NOTE-2 CM.T07A is required with MSM. However, if using both MSM. and CM., then only use only one copy of CM.T07A.

Figure 5-4. GMC JCL Structure

all required GMC files and any optional files. The user selects the programs he wants to monitor in the system, assembles those programs in numerical order, and runs a file-edit job to create a GMC object file. Figure 5-5 is an example of a GMC containing the Memory Utilization, Idle, and CPU Monitors. Figure 5-6 is an example of a GMC containing the Mass Store Monitor, Channel Monitor, and Idle Monitor. A $ GMAP card is required before the SELECTA for /GMF.TOP, and before every SELECTA after /GMF.BTM. Under normal operating conditions, the FILEDIT activity will contain multiple "Inconsistent Deck Name" error messages, which can be ignored. If a user should improperly create an R* file by omitting a required file, the GMC execution will abort with an S1-S9 abort, or an SA, SC, or SD abort, depending upon which routine is missing. The user should refer to table 5-2 for an explanation of these aborts.

The GMF is designed to be run on a HIS 6000 computer system, running with WWMCCS GCOS release 6.4 or 7.2. These releases are equivalent to the HIS commercial 2H or 4JS1 GCOS releases.

When GMF is used on WWMCCS release 7.2, or commercial release 4JS1-4JS3, the user must insure that the value for variable "SYS64" is set to 0. This variable is defined in an "EQU" statement located in the following files: B29IDPXO/GMFCOL/GMF/GMF.TOP, B29IDPXO/GMFCOL/CM/CM.TO7A, B29IDPXO/GMFCOL/CPU/CPU.T70 and B29IDPXO/GMFCOL/MUM/MUM.T10. See subsection 2.6.2 for a discussion of other GMC modifications that are required under different GCOS software releases.

Having created a GMF object file, no other system modifications are required unless the GRT Monitor, the TPE Monitor or the TSS Monitor are desired. Each of these monitors require system modifications to be made prior to their use. The system modifications required by the GRTS Monitor are described in subsection 5.2.7 of this chapter. The system modifications required by the TPE Monitor are described in subsection 5.2.9 of this chapter. The system modifications required by the TSS Monitor are described in subsection 5.2.10 of this section.

5.7 JCL for Executing the GMC

The JCL needed to execute the GMC is shown in figure 5-7. The size to be placed on the $ LIMITS card depends on the number of monitors present in the R* file. The size should range from 15K to 24K, depending on the number of monitors. The load map produced on the compilation listing from the General Loader will specify the actual memory size required to load GMC. In figure 5-7, parameter card following $ DATA I* demonstrates a turnoff for the MUM, CPUM, TM, GRTM, IDLE, TPEM monitors, and a collection of an unlimited number of tapes. If the GRTS monitor is active, it may dynamically grow GMC during its initialization procedure. Because of this feature, the GRTS monitor requires a $ LIMITS card with a large SYSOUT request to force the system to obtain an extra 1K memory. Figure 5-8 shows the

Table 6-1. (Part 4 of 4)

ID Number/Name	Other Reports
37/PALC	Peripheral Allocator Report
38/ACTIVE	Activity Report/Excessive Resource Report/Abort Report/IDENT Report
39/MAP	Memory Map
47/OUT	Out of Core Report
---	Special Job Memory Reports
---	System Program Usage Report
---	Memory Statistics Report
---	Distribution of Urgency Over Time Report
---	Zero Urgency Job Report

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Table 6-3. Default Values for Plots

ID #	Max Size of Plot	Lower Plot Limit	Upper Plot Limit
26	Unlimited	0.	456.
27	Unlimited	0.	456.
28	Unlimited	0.	114.
59	Unlimited	0.	228.

Table 6-4. Available Report Actions and Their (Default) Values (Part 1 of 2)

HISTG - Modify a histogram (see table 6-2)

PLOT - Modify a Plot (see table 6-3)

ON - Turn a specific report on - (all reports on except Memory Map and Out of Core Report)

OFF - Turn a specific report off - (all reports on except Memory Map and Out of Core Report)

TIME - Set a timespan(s) for reporting - (total time reported)

ALLOFF - Turn all reports off except those specified - (all reports on except Memory Map and Out of Core Report)

ALLON - Turn all reports on except those specified - (all reports on except Memory Map and Out of Core Report)

ERROR - Do not stop on an option request error - (stop on an input error)

DEBUG - Program debug requested - (no debug)

ALLOC - Stop program after a specified number of memory allocations have been requested - (entire tape processed)

NREC - Stop program after a specified number of tape records have been processed - (entire tape processed)

NOUSER - Do not print USERID on any repot - (USERID printed on certain reports)

IDLE - Turn off all Idle Monitor reports - (all IDLE reports on)

WASTED,CORE,IO,CPU,RATIO,URG - Changes parameters used in the Excessive Resource Usage Report - (20K,50K,30MIN, 30MIN,5,40)

ABORT - SNUMBS not to report in the ABORT Report - (all SNUMBs that abort are reported)

PLTINT - Change Interval at which plots are printed - (10 MIN)

FSTSLV - Change the lowest allowable user program number - (14 decimal)

MASTER - Define SNUMBs that are considered to be SYSTEM jobs - (all programs with a program number less than FSTSLV)

Table 6-4. (Part 2 of 2)

PALC - Change the print control for the PALC report (600 secs)

END - Required as last card of input. It must be present.

SPECL - Produce the Special Job Memory Reports

RN - Processing on a WW6.4 system

MAPART - Produce a memory map only when the number of jobs waiting memory surpasses a predetermined value.

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6.1.21 Change the Program Number for the First Slave Job (Action Code FSTSLV). In the GCOS system, certain program numbers are assigned to system jobs. For example $CALC is program number 1, $PALC is program number 2, $SYOT is program number 3, etc. In the WWMCCS system, all programs with a program number less than 14 (decimal) are considered system programs. This option allows the user to alter this program number from its default value of 14. The first card contains the word FSTSLV and the second card contains the new program number. For non-WWMCCS systems, FSTSLV should normally be set to 10.

6.1.22 Request that Certain Jobs be Considered System Jobs (Action Code MASTER). There are certain jobs executed during the course of a day which have program numbers that would designate these jobs as user jobs. However, in actuality they are system jobs and should be considered as system overhead. Examples of such jobs are VIDEO, HEALS, the GMF MONITOR, etc. This option allows the user to define up to ten jobs that should be considered as system jobs. The first card contains the Action Code MASTER. The second card contains the number of jobs to be defined as system jobs. The third card contains the SNUMB of each job to be considered as a system program. Each SNUMB must be followed by at least one blank column.

6.1.23 PALC Report Print Control (Action Code PALC). Due to the excessive amount of output possible from the PALC report, a time control can be set to print only those activities that are in any PALC state greater than the time limit. This time limit defaults to 600 seconds (10 minutes). The first card contains the word PALC and the second card contains the new time limit, in seconds.

6.1.24 Request the Special Job Memory Reports (Action Code SPECL). If the analyst desires to track the memory demands for a specified number of jobs (not to exceed ten), this input option should be invoked. This option will cause two reports to be produced. One report will indicate every time the requested job(s) was swapped or issued a MME GEMORE/GEMREL for memory, how long it was swapped, or how long the GEMORE was outstanding, and how much memory the job(s) required. In addition, every time the special job issues a MME GEMORE, a line from the Memory Map Report will be generated. This line is generated by default and is not dependent upon whether or not the Memory Map Report is enabled. It should be noted that when TSS issues a MME GEMORE, a line of the Memory Map will not be produced. When the analyst wants to match the Memory Map output to the Special Job output, he must do so based on the time value. For example, if the Special Job Report indicates that FTS issued a MME GEMORE at 16.81057, the user would then examine the Memory Map for a line of output with a time smaller than 16.81057, but where the time on the next line is greater than or equal to 16.81057. For example, the Memory Map might have a line of output with a time indication of 16.81052 where the next line of output was 16.81065. In this case, the line of output at 16.81052 shows what memory looked like at the instant in time that FTS

issued the MME GEMORE. If the Special Job Report indicates that FTS was swapped after issuing the MME GEMORE, the analyst could examine the Memory Map in order to determine why FTS was forced to swap.

A line of the Memory Map is also generated every time the GEMORE for the special job was denied or the special job was forced to swap in order for the GEMORE to be satisfied. By generating the Memory Map, the analyst can determine if there are certain jobs that are preventing other jobs from acquiring required memory resources. In this case, the Special Job Report and Memory Map Report can be correlated by matching up the time values from both reports with the identical time values. This is especially useful in an analysis of the Timesharing Subsystem or the File Transfer System.

A second report will also be produced which indicates the average memory size of the job(s) during the course of its execution. This average is taken over increments of time where the time increment used, is the same increment that is used to produce the series of plots. The option consists of three cards where the first card contains the word SPECL, the second contains the number of jobs to be analyzed, and the third card contains the list of SNUMBs separated by at least one blank column.

6.1.25 Process Data on a WW6.4 System (Action Code RN). If the data reduction program is to be run on a WW6.4 system, the user must use this input option. It consists of the letters RN typed on a data card.

6.1.26 Produce a Memory Map Only Under Certain Memory Demand Conditions (Action Code MAPART). Due to the enormous amount of output generated by the Memory Map and Out of Core Reports, it is suggested that a site not produce these reports as a standard procedure. However, these reports are very useful in that they do provide a complete picture of memory as well as a total list of all jobs waiting for memory. In order to provide an analyst with the capability of obtaining these reports, without being buried in computer output, this new option has been designed. When used, this option states that a line of the Memory Map and Out of Core Reports should be generated only when the number of activities waiting for memory surpasses a certain limit. To invoke this option, a two-card format is required. Card 1 contains the word MAPART and card 2 contains the number of activities that must be waiting memory before a line of output will be generated for the Memory Map and Out of Core Reports.

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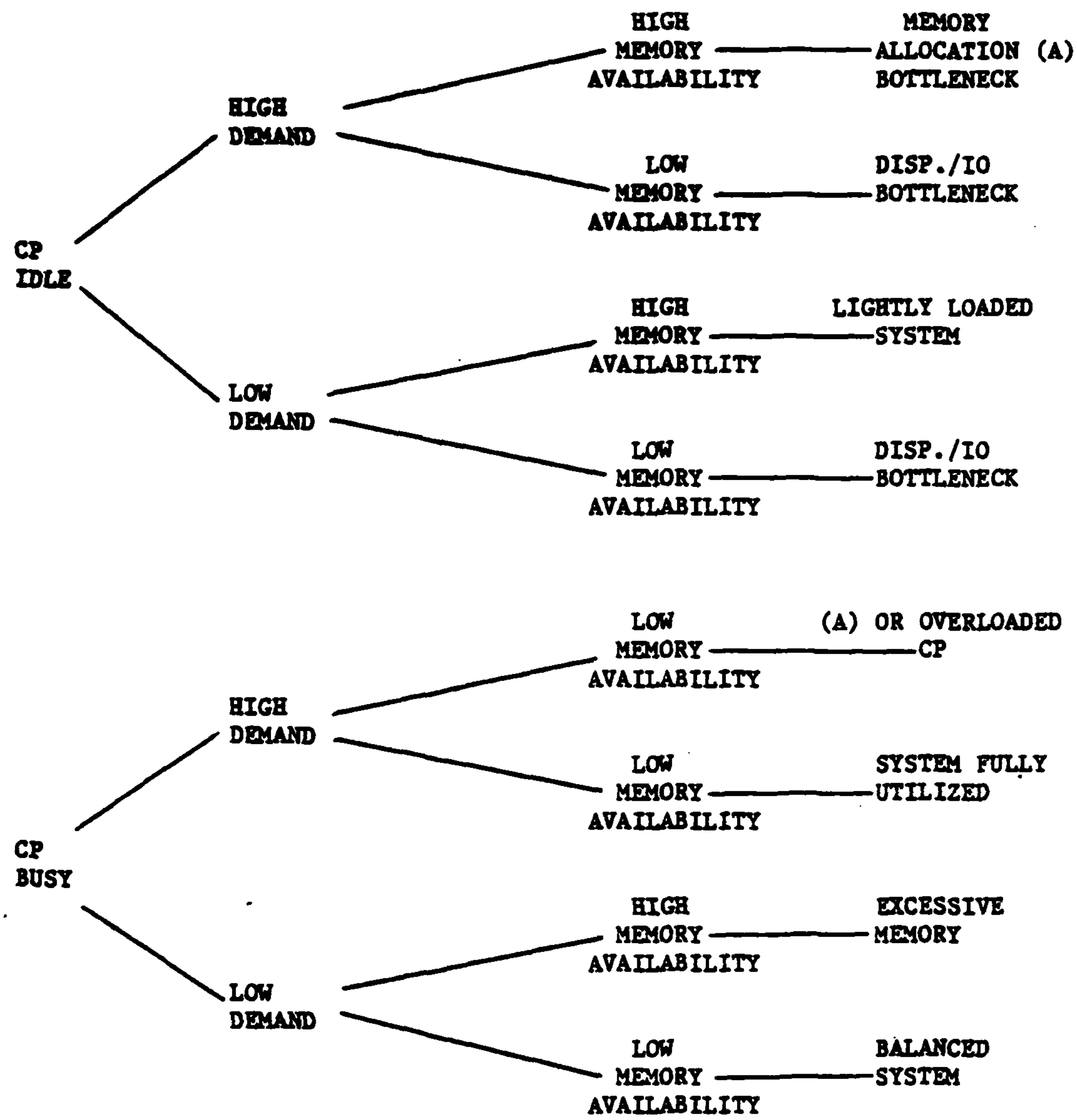

Figure 6-7. System Bottleneck Chart

Table 6-5 shows all the MUDRP file codes and their corresponding reports.

6.3 Outputs

In this section, a simple explanation of how each report was derived from the data is given. Subsection 6.1 discussed how the ranges and other options of each report may be modified to fit an individual installation.

Immediately prior to the output of the histograms, the user will find a printout containing processing information. Included in this information is the following:

- o Printout of all input options selected by user
- o Indication of multireel tapes that are being requested and have been mounted
- o Indication of the monitors that were active during data collection
- o Error messages - all error messages are either self-explanatory or else followed by the words "For Information Only." The latter messages are used by CCTC for future enhancements and as such can be ignored by the user.
- o If the time frame option was used, an indication of when the various time frames were reached.

6.3.1 MUM Title Page. The Memory Utilization Monitor (MUM) title page contains a summary of the systems configuration and activity over the measurement period (see figure 6-9). It displays the time the monitor was initiated and terminated, as well as identifying the system which was monitored and the tape number(s) containing the data. The configuration information is augmented by the amount of memory dedicated to the operating system itself, including that used by the memory allocation program. These figures will give the user a good idea of how much hard core space remains and could be used for SSA module hard core loading. If SSA cache is also configured the amount of memory being used for this feature is also listed. The version number should be 01-82.

Immediately following is a summary of the work processed over the measurement priod. The first set of lines provides information concerning the overhead generated by the actual data collection. The monitor name is given, its CPU time in seconds, and its overhead as a function of total processor power. The GMF executive overhead is separated from the actual monitors and is listed as "EXEC". The monitor "NAME" is an area of code within the Mass Store Monitor and even though listed separately it is also included under the monitor "MSM". The Monitor "FMS" is also an area of code within the Mass Store Monitor, but in this

Table 6-5. File Code for MUM Reports
(Part 1 of 2)

20	Activity Resource Report, Special Job Reports
21	IDENT Report
22	Special Job Report (temporary file)
23	Special Job Report (temporary file)
24	Urgency Over Time Report (temporary file)
26	Zero Urgency Job Report (temporary file)
27	Activity Abort Report
31	Plot 1 - (see table 6-1 for Plot Definition) (temporary file)
32	Plot 2 - (see table 6-1 for Plot Definition) (temporary file)
33	Plot 3 - (see table 6-1 for Plot Definition) (temporary file)
34	Excessive Resource Report
35	Plot 4 - (see table 6-1 for Plot Definition) (temporary file)
36	Used for outputting all plots
37	Used for outputting Out of Core Report, Memory Map, and Peripheral Allocator Report
42	Histograms, System Program Usage Report, Memory Statistics Report, Distribution of Urgency Over Time Report, Zero Urgency Job Report
45	Out of Core Report (temporary file)
51	Memory Map Report with one file required for each 128K Memory configured (temporary file)
52	Memory Map Report with one file required for each 128K Memory configured (temporary file)
53	Memory Map Report with one file required for each 128K Memory configured (temporary file)
54	Memory Map Report with one file required for each 128K Memory configured (temporary file)

Table 6-5. (Part 2 of 2)

55	Memory Map Report with one file required for each 128K Memory configured (temporary file)
56	Memory Map Report with one file required for each 128K Memory configured (temporary file)
57	Memory Map Report with one file required for each 128K Memory configured (temporary file)
58	Memory Map Report with one file required for each 128K Memory configured (temporary file)
59	Demand List Report (temporary file)

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In both this report and the following report, two special SNUMBs may appear. These SNUMBs are GWAKE an WAITL. These SNUMBs will appear for any activity that was in GWAKE or waiting original core allocation during the entire monitoring sesion. Due to the manner in which the data collector determines the SNUMB of a job, the real SNUMBs are not known for activities in either of the above categories.

6.3.5 SNUMB-IDENT Report. The SNUMB-IDENT Report is used to correlate the SNUMB, IDENT, and USERID of an activity. This allows operations personnel to identify each job reported in the Memory Map and Activity Usage Reports with a particular user (see figure 6-16).

The report displays the SNUMB, activity number, as well as the $IDENT and $USERID cards supplied at run time. The report also supplies the start and stop times of the activity. Following the stop time are four columns of data describing the urgency demands made by the activity. The four columns are: IU (Initial Urgency), AU (Average Urgency), HU (Highest Urgency) and MU (Minimum Urgency). At the far end of an entry, the type function being performed by an activity (i.e., GELOAD, FILSYS, COBOL, FORTY, etc...) is also presented.

The average urgency of an activity is merely the summation of urgencies recorded for this activity in each memory trace divided by the total number of times the urgency was recorded. It should be noted that GCOS may alter a job's urgency to as high as 63 for very short periods of time, and this will be recorded under the HU column. However, the value recorded under the AU column will be a much more accurate representation of the activity's true urgency during processing.

As each activity terminates, its entry is made to this report. Upon termination of the monitor, a summary of each activity still being processed at monitor termination will be given below a line of asterisks. These activities will include the system jobs and will provide an indication of system costs.

6.3.6 Memory Map Report. The Memory Map Report supplies a complete mapping of memory allocation. Memory is broken down into 128K half-quadrant sections and is displayed as such. This report can produce a tremendous quantity of data. Users should consider using time intervals any time the Memory map is to be produced.

Total memory can be pictured by laying each half quadrant side by side, with a time correlation being made by using the page and line numbers supplied on each output. The output is lined up by matching page number and quadrant numbers. The absolute clock time for each quadrant is found on the map of the first half quadrant of the system (0 to 128K). (Refer to figure 6-17).

The first half quadrant shows the time the state was present, the time since the last state change, and the memory used by the Hard Core Modules (HCM). The HCM usage is shown via a ****HCM*** character string.

The remaining space and all other half quadrants display the allocation of memory per job activity. All memory allocated is shown and the format is as follows:

----JOBOL-XXXUYY---

with the left and right asterisks representing the upper and lower addresses of the job whose SNUMB is JOBOL, with an activity number of XXX and an urgency of YY. Each character displayed for a job (from and including the asterisks) represents 1K of memory. As a job size decreases, the format changes as follows:

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```
                 SNUMB-IDENT REPORT COLLECTED ON SYSTEM NMCC2  ON 80-12-15 AT TIME 12:39
SNUMB            START     STOP   IU   AU   HU   MU   USERID           IDENT
8437T-    2      18:21     18:27   5    5    5    5   DJ3JC32406       18200/30/4641,TEST ESET                           GELOAD
8002T-   35      18:21     18:28   5    5    5    5   DJ8XC342LE       1820214/30/2353,TSTCRE                            JOVIAL
28023-    1      18:24     18:28   5    5    5    5   DJ4XC31611       2806138/10/5093,NAV-LOOK2,C316,LINCOLN            GMAP
29827-    3      18:21     18:29   5    5    5    5   DJ8XC32301       1820011/10/2389,STATREP       SLOAN  323          GELOAD
8496T-    0      18:29     18:29   5    5    5    5   DJ3JC32406       1820020/30/4641,TEST ESET                         GELOAD
28923-    7      18:28     18:29   5    5    5    5   DJ4XI31622       2806177/30/5168,AEAHAM                            FORTY
8501T-    1      18:30     18:30   5    5    5    5   ABC005EEEEEE    ::000000000000000000000000000000000000000000000    OR
8454T-    2      18:24     18:32   5    5    5    5   DJ3NI33202       2800165/30/4683,RP                                COBOL
7776T-    8      18:26     18:32   5    5    5    5   DJ8XC341HK       1820223/30/5202,GIPSY-SRC                         GELOAD

FOLLOWING INFO MAY BE INCOMPLETE DUE TO LOST, DATA, NO EOF, OR ACTIVITY WAS ACTIVE WHEN MONITOR ENDED.
$PALC-    1      12:39     19:29  55   55   55   55
SYSOT-    0      12:39     19:29  55   55   55   55
$RGIN-    0      12:39     19:29  55   55   55   55
-TSS--    1      12:39     19:29  55   55   55   55
LOGON-    0      12:39     19:29  55   55   55   55
FSYS -    0      12:39     19:29  55   55   55   55
NCP  -    1      12:39     19:29  55   55   55   55
TELNE-    1      12:39     19:29  55   55   55   55
FTS  -    1      14:45     19:29  55   55   55   55   NET-EXEC         000000000000000000000000000000000000000000000000.MF
TLCF -    1      12:39     19:29  55   55   55   55
DMTEX-    1      12:39     19:29  55   55   55   55
DMSTA-    1      12:39     19:29  55   55   55   55   OPNSUTIL         ZZZ,OPNSTIL                                       DMSTA
VIDEO-    1      12:39     19:29  55   55   55   55   OPNSUTIL         ZZZ,OPNSTIL                                       VIDEO
7871T-    2      18:50     19:29  55   55   55   55   DJ3JC32402       1820020/30/4641,AIR PATCH TEST 5027      MEACHAM (CT20AIR
```

Figure 6-16. SNUMB-IDENT Report

```
                                   MEMORY MAP OF   THE  FIRST HALF OF THE  FIRST QUADRANT                           PAGE   1

                            30        40        50        60        70        80        90       100       110       120
LINE  TOD      DELTA    56789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678
 1- 16.57942 0.00163889 *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
 2- 16.58025 0.00083351 *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
 3- 16.58050 0.00024986 *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
 4- 16.58056 0.00005555 *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
 5- 16.58058 0.00002789 *******************HCM*******'  *---------------------FTS  -001J62-----------------------*--------JDSIP-
 6- 16.58097 0.00038886 *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
 7- 16.58097 0.         *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
 8- 16.58169 0.00072217 *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
 9- 16.58175 0.00005555 *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
10- 16.58258 0.00083327 *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
11- 16.58308 0.00049996 *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
12- 16.58314 0.00005579 *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
13- 16.58314 0.         *******************HCM*******'  *---------------------FTS  -001J62-----------------------*--------JDSIP-
14- 16.58325 0.00011110 *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
15- 16.58400 0.00074983 *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
16- 16.58403 0.00002789 *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
17- 16.58408 0.00005555 *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
18- 16.58411 0.00002766 *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
19- 16.58478 0.00066662 *******************HCM*******'  *---------------------FTS  -001J62-----------------------*--------JDSIP-
20- 16.58483 0.00005555 *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
21- 16.58483 0.         *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
22- 16.58528 0.00044465 *******************HCM*******'  *---------------------FTS  -001U52-----------------------*--------JDSIP-
23- 16.58542 0.00013876 *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
24- 16.58547 0.00005555 *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
25- 16.58550 0.00002789 *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
26- 16.58594 0.00044441 *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
27- 16.58678 0.00083327 *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
28- 16.58683 0.00005555 *******************HCM*******'  *---------------------FTS  -001J62-----------------------*--------JDSIP-
29- 16.58683 0.         *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
30- 16.58767 0.00083327 *******************HCM*******'  *---------------------FTS  -001J62-----------------------*--------JDSIP-
31- 16.58772 0.00005555 *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
32- 16.58772 0.         *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
33- 16.58775 0.00002789 *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
34- 16.58783 0.00008321 *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
35- 16.58786 0.00002789 *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
36- 16.58869 0.00083327 *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
37- 16.58953 0.00083327 *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
38- 16.58958 0.00005555 *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
39- 16.58958 0.         *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
40- 16.58958 0.         *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
41- 16.59017 0.00058341 *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
42- 16.59100 0.00083327 *******************HCM*******'  *---------------------FTS  -001U52-----------------------*--------JDSIP-
43- 16.59144 0.00044441 *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
44- 16.59153 0.00008345 *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
45- 16.59153 0.         *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
46- 16.59161 0.00008345 *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
47- 16.59164 0.00002766 *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
48- 16.59164 0.         *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
49- 16.59247 0.00083327 *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
50- 16.59331 0.00083351 *******************HCM*******'  *---------------------FTS  -001U62-----------------------*--------JDSIP-
```

Figure 6-17. Memory Map Report
(Part 1 of 3)

```
                              MEMORY MAP OF   THE SECOND HALF OF THE FIRST  QUADRANT                    PAGE   1

            140       150       160       170       180       190       200       210       220       230       240       250
LINE 23456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456
  1- U33-------**----TLNT -C01U61----*   *----------RUNPU-001U05------------**-----MUM  -001U62-------**-------ACP -001U61-------*
  2- U33-------**----TLNT -001U61----*   *----------RUNPU-001U05------------**-----MUM  -001U62-------**-------NCP -001U61-------*
  3- U33-------**----TLNT -001U61----*   *----------RUNPU-001U05------------**-----MUM  -001U62-------**-------NCP -001U61-------*
  4- U33-------**----TLNT -001U61----*   *----------RUNPU-001U05------------**-----MUM  -001U62-------**-------NCP -001U61-------*
  5- U33-------**----TLNT -CC1U61----*   *----------RUNPU-001U05------------**-----MUM  -001U62-------**-------ACP -001U61-------*
  6- U33-------**----TLNT -C01U61----*                                       *-----MUM  -001U62-------**-------ACP -001U61-------*
  7- U33-------**----TLNT -001U61----*                     *--NACE -001U00--**-----MUM  -001U62-------**-------NCP -001U61-------*
  8- U33-------**----TLNT -001U61----*            JDSUP-001*--NACE -001U00--**-----MUM  -001U62-------**-------NCP -001U61-------*
  9- U33-------**----TLNT -001U61----*            JDSUP-001*--NACE -001U00--**-----MUM  -001U62-------**-------NCP -001U61-------*
 10- U33-------**----TLNT -001U61----*            JDSUP-001*--NACE -001U00--**-----MUM  -001U62-------**-------ACP -001U61-------*
 11- U33-------**----TLNT -C01U61----*            JDSUP-001*--NACE -001U00--**-----MUM  -001U62-------**-------ACP -001U61-------*
 12- U33-------**----TLNT -C01U61----*            JDSUP-001*--NACE -001U00--**-----MUM  -001U62-------**-------ACP -001U61-------*
 13- U33-------**----TLNT -C01U61----*            JDSUP-001*--NACE -001U00--**-----MUM  -001U62-------**-------NCP -001U61-------*
 14- U33-------**----TLNT -001U61----*            JDSUP-001*--NACE -001U00--**-----MUM  -001U62-------**-------NCP -001U61-------*
 15- U33-------**----TLNT -C01U61----*            JDSUP-001*--NACE -001U00--**-----MUM  -001U62-------**-------NCP -001U61-------*
 16- U33-------**----TLNT -001U61----*                     *--NACE -001U00--**-----MUM  -001U62-------**-------ACP -001U61-------*
 17- U33-------**----TLNT -C01U61----*                                       *-----MUM  -001U62-------**-------ACP -001U61-------*
 18- U33-------**----TLNT -CG1U61----*                     *--NACE -001U63--**-----MUM  -001U62-------**-------ACP -001U61-------*
 19- U33-------**----TLNT -001U61----*                     *--NACE -001U63--**-----MUM  -001U62-------**-------ACP -001U61-------*
 20- U33-------**----TLNT -001U61----*                     *--NACE -001U63--**-----MUM  -001U62-------**-------NCP -001U61-------*
 21- U33-------**----TLNT -C01U61----*                     *--NACE -001U63--**-----MUM  -001U62-------**-------NCP -001U61-------*
 22- U33-------**----TLNT -001U61----*                     *--NACE -001U63--**-----MUM  -001U62-------**-------NCP -001U61-------*
 23- U33-------**----TLNT -001U61----*                     *--NACE -001U63--**-----MUM  -001U62-------**-------ACP -001U61-------*
 24- U33-------**----TLNT -C01U61----*                                       *-----MUM  -001U62-------**-------ACP -001U61-------*
 25- U33-------**----TLNT -C01U61----*                     *--NACE -001U00--**-----MUM  -001U62-------**-------NCP -001U61-------*
 26- U33-------**----TLNT -G01U61----*            JDSUP-001*--NACE -001U00--**-----MUM  -001U62-------**-------NCP -001U61-------*
 27- U33-------**----TLNT -001U61----*            JDSUP-001*--NACE -001U00--**-----MUM  -001U62-------**-------NCP -001U61-------*
 28- U33-------**----TLNT -001U61----*            JDSUP-001                  *-----MUM  -001U62-------**-------NCP -001U61-------*
 29- U33-------**----TLNT -001U61----*            JDSUP-001*--NACE -001U00--**-----MUM  -001U62-------**-------ACP -001U61-------*
 30- U33-------**----TLNT -C01U61----*            JDSUP-001*--NACE -001U00--**-----MUM  -001U62-------**-------ACP -001U61-------*
 31- U33-------**----TLNT -C01U61----*            JDSUP-001                  *-----MUM  -001U62-------**-------ACP -001U61-------*
 32- U33-------**----TLNT -001U61----*            JDSUP-001*--SHEAL-003U32--**-----MUM  -001U62-------**-------NCP -001U61-------*
 33- U33-------**----TLNT -001U61----*            JDSUP-001*--SHEAL-003U32--**-----MUM  -001U62-------**-------NCP -001U61-------*
 34- U33-------**----TLNT -001U61----*                     *--SHEAL-003U32--**-----MUM  -001U62-------**-------NCP -001U61-------*
 35- U33-------**----TLNT -001U61----*   *--NACE -001U00--**--SHEAL-003U32--**-----MUM  -001U62-------**-------NCP -001U61-------*
 36- U33-------**----TLNT -C01U61----*   *--NACE -001U00--**--SHEAL-000U32--**-----MUM  -001U62-------**-------KCP -001U61-------*
 37- U33-------**----TLNT -C01U61----*   *--NACE -001U00--**--SHEAL-003U32--**-----MUM  -001U62-------**-------ACP -001U61-------*
 38- U33-------**----TLNT -001U61----*   *--NACE -001U00--*                  *-----MUM  -001U62-------**-------ACP -001U61-------*
 39- U33-------**----TLNT -C01U61----*                                       *-----MUM  -001U62-------**-------ACP -001U61-------*
 40- U33-------**----TLNT -001U61----*                     *--NACE -001U00--**-----MUM  -001U62-------**-------NCP -001U61-------*
 41- U33-------**----TLNT -001U61----*            JDSUP-001*--NACE -001U00--**-----MUM  -001U62-------**-------NCP -001U61-------*
 42- U33-------**----TLNT -001U61----*            JDSUP-001*--NACE -001U00--**-----MUM  -001U62-------**-------NCP -001U61-------*
 43- U33-------**----TLNT -CC1U61----*            JDSUP-001*--NACE -001U00--**-----MUM  -001U62-------**-------NCP -001U61-------*
 44- U33-------**----TLNT -001U61----*            JDSUP-001                  *-----MUM  -001U62-------**-------NCP -001U61-------*
 45- U33-------**----TLNT -001U61----*            JDSUP-001*--SHEAL-003U32--**-----MUM  -001U62-------**-------NCP -001U61-------*
 46- U33-------**----TLNT -001U61----*            JDSUP-001*--SHEAL-003U32--**-----MUM  -001U62-------**-------NCP -001U61-------*
 47- U33-------**----TLNT -001U61----*                     *--SHEAL-003U32--**-----MUM  -001U62-------**-------NCP -001U61-------*
 48- U33-------**----TLNT -001U61----*   *--NACE -001U00--**--SHEAL-003U32--**-----MUM  -001U62-------**-------KCP -001U61-------*
 49- U33-------**----TLNT -C01U61----*   *--NACE -001U00--**--SHEAL-003U32--**-----MUM  -001U62-------**-------ACP -001U61-------*
 50- U33-------**----TLNT -C01U61----*   *--NACE -001U00--**--SHEAL-000U32--**-----MUM  -001U62-------**-------ACP -001U61-------*
```

Figure 6-17. (Part 2 of 3)

```
                                   MEMORY MAP OF    THE SECOND HALF OF THE SECOND QUADRANT                  PAGE   1

                400       410       420       430       440       450       460       470       480       490       500       510
LINE 8901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012
  1- ------------2930T-003U32-----------------------*     *--NACE -001U00--**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
  2- ------------2930T-003U32-----------------------*     *--NACE -001U00--**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
  3- ------------2930T-003U32-----------------------*     *--NACE -001U00--**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
  4- ------------2930T-003U32-----------------------*                       *---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
  5- ------------2930T-003U32-----------------------**----$PALC-001U00----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
  6- ------------2930T-003U32-----------------------**----$PALC-001U00----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
  7- ------------2930T-003U32-----------------------**----$PALC-001U00----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
  8- ------------2930T-003U32-----------------------**----$PALC-001U00----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
  9- ------------2930T-003U32-----------------------**----$PALC-001U00----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 10- ------------2930T-003U32-----------------------**----$PALC-001U00----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 11- ------------2930T-003U32-----------------------**----$PALC-001U00----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 12- ------------2930T-003U32-----------------------*                       *---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 13- ------------2930T-003U32-----------------------*     *--$HEAL-000U00--**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 14- ------------2930T-003U32-----------------------*     *--$HEAL-000U00--**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 15- ------------2930T-003U32-----------------------*     *--$HEAL-000U00--**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 16- ------------2930T-003U32-----------------------*     *--$HEAL-000U00--**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 17- ------------2930T-003U32-----------------------*     *--$HEAL-000U00--**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 18- ------------2930T-003U32-----------------------*     *--$HEAL-000U00--**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 19- ------------2930T-003U32-----------------------*     *--$HEAL-000U00--**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 20- ------------2930T-003U32-----------------------*                       *---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 21- ------------2930T-003U32-----------------------**----$PALC-001U62----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 22- ------------2930T-003U32-----------------------**----$PALC-001U62----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 23- ------------2930T-003U32-----------------------**----$PALC-001U62----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 24- ------------2930T-003U32-----------------------**----$PALC-001U62----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 25- ------------2930T-003U32-----------------------**----$PALC-001U62----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 26- ------------2930T-003U32-----------------------**----$PALC-001U62----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 27- ------------2930T-003U32-----------------------**----$PALC-001U62----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 28- ------------2930T-003U32-----------------------**----$PALC-001U62----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 29- ------------2930T-003U32-----------------------**----$PALC-001U62----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 30- ------------2930T-003U32-----------------------**----$PALC-001U62----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 31- ------------2930T-003U32-----------------------**----$PALC-001U62----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 32- ------------2930T-003U32-----------------------**----$PALC-001U62----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 33- ------------2930T-003U32-----------------------**----$PALC-001U62----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 34- ------------2930T-003U32-----------------------**----$PALC-001U62----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 35- ------------2930T-003U32-----------------------**----$PALC-001U62----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 36- ------------2930T-003U32-----------------------**----$PALC-001U62----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 37- ------------2930T-003U32-----------------------**----$PALC-001U62----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 38- ------------2930T-003U32-----------------------**----$PALC-001U62----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 39- ------------2930T-003U32-----------------------**----$PALC-001U62----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 40- ------------2930T-003U32-----------------------**----$PALC-001U62----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 41- ------------2930T-003U32-----------------------**----$PALC-001U62----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 42- ------------2930T-003U32-----------------------**----$PALC-001U62----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 43- ------------2930T-003U32-----------------------**----$PALC-001U62----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 44- ------------2930T-003U32-----------------------**----$PALC-001U62----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 45- ------------2930T-003U32-----------------------**----$PALC-001U62----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 46- ------------2930T-003U32-----------------------**----$PALC-001U62----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 47- ------------2930T-003U32-----------------------**----$PALC-001U62----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 48- ------------2930T-003U32-----------------------**----$PALC-001U62----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 49- ------------2930T-003U32-----------------------**----$PALC-001U62----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
 50- ------------2930T-003U32-----------------------**----$PALC-001U62----**---------$SYOT-000U62---------*VIDEO*SSA CACHE CO
```

Figure 6-17. (Part 3 of 3)

-JOB01-XXXU05-	(16K) including SSAs
*JOB02-XXX--	(12K)
JOB03	(7K) - activity discarded
JOB04	(5K) - asterisks discarded
****	(4K) - no identification

As can be seen in figure 6-17, Part 1, every line of the figure has a line number ranging from 1-50. In addition, there is a page number in the upper right corner. When the user wants to match this picture of the first half of the first quadrant with its corresponding half of some other quadrant, the following steps should be followed:

1- Match page numbers (see figure 6-17, Part 2, Part 3)
2- Match the line numbers from identical page numbers.

Two special names can appear in the memory map. If SSA cache memory is configured the following letters will be found in the map, depending on the size of the SSA cache memory:

*SSA CACHE**	12K	
*SSA CACHE	10K	
*SSA CAC	8K	
SSA C	5K	(see figure 6-17, Part 3)

If memory has been released from the system, then the letters *-RELEASED* will appear in the dump. This will be repeated depending upon how much memory has been released.

6.3.7 Demand List Report. The Demand List Report shows the memory demand outstanding for each memory state displayed on the memory map. The correlation is made using the same line numbers as the half quadrants of the maps themselves (refer to figure 6-18).

The Demand List Report shows the total memory available, the number of jobs waiting memory, the demand request sizes for each job waiting memory. The memory available is the sum of all holes in memory.

6.3.8 Activity Abort Request. This report is directly related to the Activity Resource Usage Report. This report is produced whenever the Activity Report is produced. For every activity that aborts during the monitoring session, an entry is made to this report. The entry gives the SNUMB, Activity Number, Abort Code, CPU Time, Run Hours, USERID, and IDENT for the activity.

The Abort Code is either an octal number or an alphanumeric value. The meaning of these codes can be found an Appendix A of Honeywell Manual DD19 (GCOS).

statement that the $LIMITS card appears to be requesting more memory than is actually required by this job. The user should be questioned in order to determine if this is in fact true. In the Honeywell System, a user will receive whatever amount of memory requested on the $LIMITS card, whether or not the amount of memory is actually needed. The Ratio column shows the ratio of the total elapsed time for an activity divided by the total memory time for the activity. This value gives an indication of the activity lengthening factor; i.e., how run time is affected by resource contention. For those activities using excessive memory, the report also indicates, under the MEM MIN column, the amount of time the activity was in memory. The value being used for the urgency check is the maximum urgency ever recorded for the activity and not the average urgency of the activity. The default values for an entry being made to this report are listed in table 6-4. These values can be changed via a previously described input option. This report will be produced whenever the Activity Resource Report is produced and will be turned off whenever the Activity Resource Report is off (see figure 6-21).

6.3.11 Peripheral Allocation Status Report. This report will track an activity as it proceeds through different phases of Peripheral Allocation. The report will list the SNUMB-Activity #, amount of memory the activity will require, its current status, the time it entered that phase of allocation, the time is completed that phase of allocation, the total time spend in a given phase of allocation, the device type it is waiting for, and the number of devices the activity is waiting for. Due to the manner in which data is collected for this report, it is possible that certain phases of allocation will be missed, especially if that phase of allocation occurs within a short time span. This report will give a good indication of how long it is taking activities to pass through the Peripheral Allocation process. Following is a list of the more common phases of peripheral allocation and their meanings:

New Act - Activity has just entered the Peripheral Allocator
Wait Media - Activity is waiting for a device
Wait Mnt - Activity is waiting for a patch or tape to be mounted
Core Queue Full - Activity has been completely processed and is waiting for the Peripheral Allocator to send the job to the core allocator
Alloc Done - Activity has been sent to core allocator. For this case the stop time and total time columns have no real meaning. These columns simple are reporting the amount of time it took the monitor to realize that the activity had reached the core allocator
LIMBO - Activity is in Limbo and has not even been granted permission to run
HOLD - Activity is in Hold and has not even been given permission to run

Only activities found to be in a PALC state for more than 600 seconds will be reported. This limit can be changed by using the PALC input option. See figure 6-22 for a sample of this report.

6.3.12 Plot Reports. Three different plot reports are produced by the data reduction program. All plots are produced under 10-minute intervals, where the interval can be modified by the user. At every allocator call, the various parameters to the plots are accumulated and every 10 minutes, the accumulated parameters are averaged and an average value is output

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EXCESSIVE RESOURCE USAGE REPORT ON SYSTEM DNAH66 ON 81-12-17 AT TIME 10:01

SNUMB-ACT	WASTED MEMORY	MEM USED	IO SECS	CPU SECS	RATIO	MEM MIN	MAX URG	USERID	IDENT
2027Q- 1		56				1.2		FCCCSE	1020,WA024,CSE,250,MCCANN,SECRET
2044T- 1		81				2.8		FCCCSE	1010,WA803,CSE,264,UARRETT,UNCL
2057T- 1		64				3.4	47	FCCCSD	1010,NS0033,CSD,283,PADILLA,UNCL
2083Q- 1		56				1.0		FCCCSE	1020,WA024,CSE,250,MCCANN,SECRT
2085T- 1		92				5.0	55	DBA	1020,TRAX.A,CSA,254,MATHEWS,SECRET
2106T- 1		81				2.7		FCCCSE	1010,WA803,CSE,264,BARRETT,UNCL
SR01 - 5		65				0.6		FCCCS	1030,SR01,CSC,250,MCCANN,TOPSEC

Figure 6-21. Excessive Resource Usage Report

```
                                   DISTRIBUTION COLLECTED ON SYSTEM NMCC2 AT 12:39:46 ON 80-12-15

                                          MEMORY SHORTFALL IN CALC VS SHORTFALL IN CALC+PALC                           PLOT- 2

DELTA=   4.0      A= CALC    B=PALC

TIME OF DAY                                                       MEMORY (K WORDS)
     0.                    112.0                       228.0                        340.0

Y---------Y---------Y---------Y---------Y---------Y---------Y---------Y---------Y---------Y---------Y---------Y

I                                                                                                                12:49:21.50
2                                                                                                                12:59:22.30
2                                                                                                                12:59:22.30
2                                                                                                                  .  .
2                                                                                                                  .  .
2                                                                                                                  .  .
2                                                                                                                  .  .
2                                                                                                                  .  .
2                                                                                                                  .  .
I           2                                                                                                    14:19:18.40
I           2                                                                                                      .  .
I                       A       B                                                                                  .  .
I                                                               A B                                                .  .
I                       A  B                                                                                       .  .
I                        A    B                                                                                    .  .
I                               A                                             B                                    .  .
I                            A                                                        B                            .  .
I                                       A                                  B                                       .  .
I                                    A                                                                    B      16:09:15.30

      CURVE      MINIMUM      MAXIMUM
      CALC       0.           0.1950E 03
    + PALC       0.           0.3000E 03
```

Figure 6-23. Standard Plot

6.3.13 Memory Statistics Report. This report is produced after the histograms. It details all the information needed to start a system analysis as detailed in section 14. The report is shown in figure 6-24. The values for this report are obtained as described in section 14.6.3.

6.3.14 Special Job Memory Reports. This report details the memory demands made by a series of jobs specially requested by the analyst (see SPECL option). Figures 6-25 and 6-26 display the format for these reports. Figure 6-25 displays the Memory Demand Report. Every time one of the specially requested jobs issues a MME GEMORE for memory, gets swapped out/into memory, or release memory, an entry is made to this report. In figure 6-25, we see that FTS issued a GEMORE for 1K of memory at 11:47:03. The time is presented in hours and fraction of an hour as well as in hours, minutes and seconds. At the time of the GEMORE, FTS was at 35K. The -99999 in the Time to Satisfy column indicates that this was the time when the GEMORE was issued (and the request has not yet been satisfied or denied). The GEMORE was satisfied at 11:47:03 after a wait of 0 tenths of a second. The fact that the request was satisfied is indicated by the word MET under the DEMAND TYPE column and also the fact that FTS is now at 36K. The last column of the report can be used to determine how many cycles through the memory allocator were required before the request was satisfied or denied. The GEMORE request was made on the 82nd call to the allocator and was satisfied on the 83rd call to the allocator. At 11:47:09, FTS issued another GEMORE request that was DENIED 10 tenths of a second (1 second) later. This denial was immediately followed by a SWAP which lasted 2 tenths of a second. When FTS returned from the SWAP, it had received the 4K of memory that had been denied from the earlier GEMORE request. Finally, at 11:47:39, FTS released (GEMREL) 1K (-1) of memory and its size was reduced to 39K. At preselected intervals (same interval constraints used to produce the plots), a summary line is printed indicating the total wait time accumulated by the job during that interval of time. It should be noted that this option can cause the Memory Map to generate output even if the Memory Map Report has not been activated (see subsection 6.1.24).

6.3.15 Distribution of Urgency Over Time Report. This reports (figure 6-27) is always produced and cannot be turned off. An entry is this report is made under the same time interval contraints as the memory plots. The report displays the average distribution of urgencies present in the system during each interval of time. Therefore, between 14:06 and 14:16, 39.9% of all activities active in the system had an urgency level of 5, while 5.8% had an urgency level of 30. Urgencies are grouped in classes of 5 (i.e., 0-4 reported as 0, 5-9 reported as 5, etc.). The urgency classes of 55-60 and 60-65 are further subdivided into user activites (u) and system activities (s). The summary at the bottom of the page indicates, for each activity processed in the system, what percentage of activities reached a maximum urgency of the indicated level. Therefore, in figure 6-27, we see that 40.2% of all activities processed had a maximum urgency of 5, while 7.1% of all activities processed were user activities with a maximum urgency between 60-64, and 3.3% of all activities processed were system activities in the same urgency class.

The greatest consideration to an urgent job (40) is given with respect to allocation denial. If a priority job is denied and less than 3 jobs are active, the allocation overdue status is set immediately for that job. Allocation overdue will not be set for a routine job until 50 activities have been allocated. In any case, if a priority job is denied allocation, a flag is set signifying this. Until all urgent jobs have been allocated, all nonpriority new job or first activity entries in the job stack will be ignored. New activity entries will be processed, but it can be seen that needed peripherals could go unused for great lengths of time.

There are two algorithms available for determining when a program may receive processor service. The algorithm used at a given site is dependent upon a site option patch that is included in the start-up deck.

Option 1 is called "urgency throughput" and involves jobs being placed in the processor's queue based on their priority. Priority is computed as the job's urgency divided by four. With WIN and other system programs running at an urgency of 61 and user jobs running at urgencies of 40 and above, their relative priorities are very close (15 for WIN and other system programs and 10 or higher for the user activities). Each time a job is dispatched, its priority is decremented by one, and upon reaching zero is recomputed. Based upon this algorithm, WIN programs will theoretically have a priority higher than the user jobs for only one-third of the cycle. The other two-thirds of the time, when its priority drops below 10, WIN programs will be competing for the processor with many other less critical jobs as an equal.

Option 2 is called "I/O priority" and involves giving priority to heavy I/O type jobs. The reasoning behind this is that an I/O bound job will not require the processor for extended periods of time so, therefore, the system will give this job the processor so that it can perform its minimal CPU functions, issue an I/O request, and be removed from the processor queue.

Since WIN software (with the possible exception of FTS) does not perform much I/O, this puts any I/O bound slave job at a higher priority than the WIN software. This means that this I/O bound job will always go into the dispatcher's queue before the WIN software and most other critical software.

6.3.16 Zero Urgency Job Report. According to the GCOS software documentation, the Core Allocator will swap out any job with a zero urgency, if there is an outstanding demand for memory. During several system studies performed by CCTC, it has been observed that this swapping of zero urgency jobs does not always appear to be occurring. This report lists all those jobs which were observed as having a zero urgency, but were not swapped by the Core Allocator. A job is entered in this report only when the following conditions exist:

- job has a zero urgency
- there is an outstanding demand for memory
- the size of this zero urgency job is sufficient to satisfy at least the smallest memory demand currently outstanding.

The report indicates the SNUMB and Userid of the job, the start and stop times of the job, the total amount of time (.1 sec) that the job satisfied all conditions stated above, and finally, the total percent of time that the job was in memory under the above conditions. Other reports would indicate the size of the jobs listed in this report and the level of outstanding demand that was present on this system, while this job was in execution. Figure 6-28 shows a sample of this report.

6.4 Error Messages

All error messages are self-explanatory or else followed by the words "For Information Only." In this case, the message can be ignored and processing will continue, without error.

SPECIAL JOB MEMORY SIZE REPORT ON SYSTEM NMCC ON 82-03-01

TIME	SNUMB	AVG SIZE	SNUMB	AVG SIZE	SNUMB	AVG SIZE
1415	FTS	63	NCP	29	TS1	124
1426	FTS	56	NCP	29	TS1	120
1436	FTS	47	NCP	29	TS1	81
1446	FTS	38	NPC	29	TS1	114

Figure 6-26. Special Job Memory Size Report

DISTRIBUTION OF URGENCY REPORT OVERTIME

URGENCY	0	5	10	15	20	25	30	35	40	45	50	55U	60U	55S	60S
14:06	0.	41.9	1.5	1.2	1.3	0.7	0.9	0.	0.1	0.	0.	16.7	9.1	8.7	18.1
14:16	0.	39.9	0.	0.	0.2	0.	5.8	0.	0.	0.	0.	20.6	8.6	8.4	16.5
14:26	0.	44.3	0.	0.	0.3	0.	2.2	0.	0.	0.	0.	12.5	10.6	9.6	20.6
14:36	0.	40.3	0.	0.	0.1	0.1	5.2	0.1	1.4	0.	0.	9.6	9.0	7.1	27.0
14:46	0.	46.5	0.8	1.1	2.3	0.1	1.9	0.	0.1	0.5	4.2	6.4	6.9	6.2	22.9
14:56	0.	40.6	0.	0.	0.1	0.	6.1	0.	0.0	0.	7.2	11.9	7.1	5.5	21.4
15:06	0.	45.3	3.1	0.	0.2	0.	3.4	0.	0.	0.5	1.1	9.2	8.9	5.5	22.8
15:16	0.	46.0	0.2	1.1	2.9	0.	5.7	0.	0.	0.	0.	7.8	8.3	5.1	22.8
15:26	0.	45.0	0.	0.	3.5	0.	7.4	0.	0.	0.	0.	11.1	11.9	5.1	16.2
15:36	0.	41.9	0.	0.	0.0	0.	7.3	0.	0.	0.4	6.3	12.3	8.3	6.4	17.0
15:46	0.	48.5	0.	0.	0.2	0.	5.5	0.	0.0	1.0	3.1	10.1	6.0	5.8	19.8
15:56	0.	48.5	0.	0.	0.4	0.	5.9	0.	0.	1.3	0.	12.5	6.8	6.6	18.0

SUMMARY OF ACTIVITIES OVER THE TOTAL DURATION

0.	40.2	0.	0.	10.0	0.4	3.3	0.	2.9	7.1	2.9	22.2	7.1	0.4	3.3

Figure 6-27. Distribution of Urgency Over Time Report

ZERO URGENCY JOB REPORT FOR SYSTEM NMCC ON 82-08-25

SNUMB-ACT	USERID	START	STOP	TIME AT ZERO URGENCY AND DEMAND FOR MEMORY WAS PRESENT (.1 SEC)	% OF MEMORY TIME JOB WAS IN ZERO URGENCY STATE AND MEMORY DEMAND PRESENT
$PALC - 1		1630	1715	835	3%
$RTIN - 0		1630	1715	75	0%
$LOGN - 0		1630	1715	51	0%
TLCF - 1		1630	1715	15	0%
DMSTA - 2	OPNSUTIL	1630	1715	9	0%
ESS - 1	DJ8XI342RBR	1714	1715	81	62%
NACE - 1	OPNSUTIL	1630	1715	1167	4%

Figure 6-28. Zero Urgency Job Report

6.5 Multireel Processing

If more than a single reel of data has been collected, a series of messages will be printed at the computer console informing the operator that a new data reel is required. The following are the messages produced.

a. DISMOUNT REEL #XXXXX THEN MOUNT REEL NUMBER YYYYY ON ZZZZZ

In this case, XXXXX is the old reel number, YYYYY is the new reel number, and ZZZZZ is the tape drive ID.

If the operator fails to mount the new tape, the above message will be repeated three times, after which the program will terminate, and all reports will be produced.

b. IS TAPE XXXXX MOUNTED ON DRIVE ID YYYYY (Y/N)

In this case, XXXXX is the tape number being requested and YYYYY is the appropriate tape drive ID.

This message occurs when the data reduction program finds the wrong tape has been mounted (by comparing internally generated tape labels). If the operator answers N, the message in (c) below is produced. If the operator answers Y, the data reduction program will terminate and all reports will be produced. In this case, the data reduction program is unable to process the tape. Even though the operator is mounting the correct tape, the internal label on the new tape does not match that being requested by the old tape. The user should check the data collection session to insure that the operator did not respond with an incorrect tape number during multireel change.

After entering the Y or N, the operator will need to hit the EOM key twice in order for the response to be transmitted.

c. WRONG REEL JUST MOUNTED, DISMOUNT AND MOUNT REEL XXXXX ON ZZZZZ

In this case, XXXXX is the new reel number, and ZZZZZ is the tape drive ID.

d. CAN TAPE XXXXX BE MOUNTED ON DRIVE YYYYY (Y/N)

In this case, XXXXX is the new desired reel and YYYYY is the tape drive ID.

If the operator fails to answer this message, it will be repeated until he responds with a "Y" for YES or "N" for NO. If he types in "Y", then message (a) will be repeated. If he types in "N", then the program will be terminated and all reports will be produced.

SECTION 7. MASS STORE MONITOR DATA REDUCTION PROGRAM (MSMDRP)

7.1 Introduction

The Mass Store Monitor Data Reduction Program is a FORTRAN program that sequentially processes data the Mass Store Monitor collected and wrote on tape. MSMDRP produces a number of reports depicting the physical and logical usage of the mass storage subsystem during the monitoring period. A list of these reports is found in table 7-1 and report descriptions are presented in subsection 7.5.

The Mass Store Monitor and its Data Reduction Program were conceived as a response to the need for information on the rate and characteristics of usage of mass store subsystems. The information collected is applicable in the following areas:

- o Discovery of improper configurations (software or hardware), e.g., not alternating usage of dual physical channels configured on a subsystem.
- o Discovery of improper device utilization, e.g., use of only a small number of the devices configured instead of having the activity spread over all configured devices.
- o Discovery of open file allocation on a device which can cause long and frequent arm movement.
- o Identification of files (either system or user data base) which are frequently accessed and quantification of the rates of access to them.

There are two inputs to the MSMDRP. The first is the data tape produced by the MSM in the General Monitor Collector. The second input is a set of report option control cards used to alter the reports in some way other than the standard default. The various user input options and their formats are described in subsection 7.6. The actual reports produced by the MSMDRP are described in subsection 7.5.

The Mass Store Monitor Data Reduction Reports can be used to assist the analyst in applying models in the area of system performance evaluation by providing computer system resource usage information in a format conducive to defining the system workload. Models of computing systems are frequently used to evaluate configurations which are not currently available or are perhaps unrealized. The usefulness of this type of model depends upon two basic characteristics: (1) how faithfully the model represents the operation of the system being modeled, and (2) how faithfully the input parameters to the model represent the workload to be placed on the system. MSM and MSMDRP are key contributors to such model development.

Table 7-1. MSM/MSMDRP Reports (Part 1 of 2)

1 System Configuration and Channel Usage Report (File 42)

2 System Summary Report (File 42)

3 System Traces Captured by Monitor Report (File 42)

4 Channel Status Changes Report (File 29)

5 Physical Device, Device ID Correlation Table Report (File 42)

6 Device Space Utilization Report (File 42)

7 Device Seek Movement Report (File 42)

8 Head Movement Efficiency Report (File 42)

9 System File Use Summary Report (File 21) (SYSFILES)

10 Individual Module Activity Report (File 21) (SYSFILES)

11 SSA Module Usage Report by Job (File 21)

12 File Code Summary Report (File 23) (FILECODE)

13 CAT/File String Report (File 23)

14 Connect Summary Report by Userid/SNUMB (File 23)

15 Activity Summary Report (File 24) (ACTIVITY)

16 Device Area File Code Reference Report (File 22) (AREA)

17 Device File Use Summary Report (File 21) (FILEUSE)

18 Chronological Device Utilization Report (File 26) (CHRONO)

19 FMS Cache Report (File 21)

20 Connects Per 10 Minute Report (File 20) (RATE)

21 Proportionate Device Utilization Report (File 42)

22 Elapsed Time Between Seeks Report (File 42)

23 Data Transfer Size Report (File 42)

24 Data Transfer Sizes for TSS Swap Files (File 42)

7.2 Data Collection Methodology

The MSM in the General Monitor Collector processes GCOS trace types 7 and 15 and collects information to monitor the usage of the entire disk subsystem. The information collected on the occurrence of the above traces enables the MSMDRP to identify the activity issuing the I/O request, the file being accessed, the disk pack upon which the file is located, arm movement required in order to accomplish the requested file accessing, and the type of accessing being requested; e.g., read, write, write verify, etc.

If the system being monitored by the MSM is configured with SSA Cache Core, the MSM will create two direct transfer traces (types 73 and 76) in order to collect data to analyze the effectiveness of SSA Cache Core. The method for generating these new direct transfer traces is described in subsection 5.2.2, and the formats for the MSM generated records used by the MSMDRP are described in subsection 5.4.3.

Finally, if the system being monitored by the MSM is configured with FMS Catalog Cache or is utilizing disk in core space tables, a data record is generated so that the MSMDRP can report on the effectiveness of FMS Catalog Cache or in core space table buffering.

7.3 Analytical Methodology

An evaluation of the Mass Storage Subsystem reports produced by the MSMDRP requires concurrent use of the reports produced by the Channel Monitor Data Reduction Program (CMDRP). Chapter 14 provides a detailed description of the procedure to be followed in such an evaluation. Subsection 8.3 provides a detailed description of the entire I/O process, and the traces generated during the processing of an I/O request. In general, the CMDRP is used to identify channels and/or devices which are acting as bottlenecks to the efficient operation of the system, while the MSMDRP reports are used to determine the exact activities, files, and file codes that are causing the contention uncovered by the CMDRP reports. The MSMDRP reports will also identify those devices experiencing seek elongation problems and the files upon these devices which are responsible for the seek elongation. Finally, the MSMDRP reports will identify those files that are candidates for device relocation or placement into Hard Core or SSA Cache Buffer space.

Before a user conducts a Mass Storage Subsystem Evaluation, it is important to have an understanding of the entire I/O process. Subsection 8.3 provides a detailed description of the entire I/O process and all traces generated during the processing of an I/O request. In this subsection, a description of only the connect (trace type 7) event will be presented.

Each time a system program or application program issues an I/O request (read disk/tape, write disk/tape, seek, etc. . .) the GCOS system will generate a trace type 7 (connect event). Upon the occurrence of this event, several internal tables are updated and it is these tables that the

MSM references in order to generate its data record. A program's SSA area contains tables for the Peripheral Assignment Table (PAT) and the PAT Pointer. These are used to describe the device and space allocation for a particular file and the file code to correlate a user file code to the PAT and the device on which that file is allocated. The .CRIO and .CRCT tables contain descriptive information concerning device and channel configuration. Finally, the program's SSA area also contains an area which is used for I/O entries. These entries are each 11 words long and contain detailed information concerning the I/O just requested. They are referred to as the 11 word I/O queue entry.

I/O requests can be of two types (single or multicommand). Multicommands are of the type seek-read, seek-write, or seek-write verify. Single commands can be status requests of certain types, or reads/writes, where seeks are not required. These different types of I/O commands are processed and reported in different fashions by the various MSMDRP reports (see individual output reports). Finally, whenever the system generates a multi I/O command, it is necessary for the system to record the actual seek address being requested. Normally, this seek address is stored in I/O queue word number 4. Whenever the MSM processes a multicommand, it expects to find a valid seek address at this location. However, there are certain occurrences when a multicommand is issued and I/O queue word 4 does not contain a valid seek address. In these cases, Bit 32 of I/O queue word 2 is set to a 0. The Computer Performance Evaluation Office is currently conducting studies to determine exactly when this nonstandard procedure occurs and if there is any manner in which the MSM can determine the correct seek address. Under the current processing procedures, the MSMDRP recognizes the seek address as being invalid and performs certain special processing in order to recover from this event, thereby affecting several of the output reports (see individual output reports). This software release has a code included to correct this problem. Therefore, no occurrences of this condition should be reported in any of the MSM output.

7.4 Data Reduction Methodology

The MSMDRP currently uses random I/O (File 58) to process histogram data for the Device Space Utilization and Device Seek Movement reports. This feature allows the MSMDRP to process an unlimited number of devices with a minor increase in memory requirements. As delivered, the MSMDRP will process data describing 75 mass storage devices and 40 mass storage channels. It will produce 64 unique histograms with no random I/O. If the number of channels or devices is insufficient, the user will need to edit file B29IDPXO/SOURCE/MSM. The user should enter the edit subsystem and process the following command:

```
B RS:/NRDEVXX=XX75/;*:/NRDEVXX=XX new number of devices/

B RS:/NRCHANXX=XX40/;*:/NRCHANXX=XX number of new channels/
```

For each additional device, the size of the program will increase by 10 words and for each additional channel, the program will increase by 45 words. For the above edit, the character "X" signifies a space.

7.5.2 System Summary Report (File 42). The System Configuration and Channel Usage Report and the System Summary Report may be used to assess overall system utilization. Figure 7-2 is an example of the System Summary Report. The first set of lines shows the number of connects to the monitored mass storage subsystems compared to the total connects issued (TAPE+DISK) and the connect rate per hour over the subsystem. Most systems will show a small number of Control Connects being generated by the MPCs configured to the system. These Control Connects will be summed together and listed as a separate subsystem line. Analysis on a Shared Mass Storage System shows the number of MPC connects generated to be a significant percentage of the total connects generated. The next lines show the breakdown of the mass storage connects by the IOM channel over which they were issued. The final part of this report is a list of the commands (octal code and mnemonic) issued to the mass storage subsystem and the count of each issued during the monitoring session. This report is always generated and cannot be turned off.

A well performing system, under a heavy workload, should show a high utilization of the configured resources. Figure 7-2 shows that the I/O activity is predominantly on the MSU450 subsystem configured on channels 8 and 9 of IOM 0 and 1 (see figure 7-1). The MSU450s are receiving 51% of all connects and, therefore, should be the major area of concern. The access rate for every subsystem is reported on the top of the System Summary Report and it can be seen that the MSU450s have an access rate significantly higher than the other subsystems. All signs indicate that if system throughput is being affected by disk activity, then the MSU450s would be the probable cause of such problems.

The next item to check on these two reports should be the channel usage. The two highest used logical channels of any subsystem should be on a separate PSI channel of a two-PSI channel subsystem. Referring to figure 7-2, one can see that logical channel 8 of IOM 0 and IOM 1 has the highest usage, and this is the proper configuration. If the highest used logical channels are not on separate PSI channels, the $ XBAR card in the startup configuration section is suspected as the cause. The channels are used in the order given on the $ XBAR card (i.e., if the primary channel is busy, the next channel tried is given on the crossbar). The alternate use of PSI channels for maximum simultaneity must, therefore, be appropriately specified in the boot deck. Subsection 8.3 provides a detailed explanation for analyzing the correctness of the crossbar configuration.

While looking at the System Summary Report, it is also of interest to note the ratio of READ commands to WRITE commands (over two to one in this example). This gives an indication of the nature of the usage of the mass storage space. A quick look at the number of write/verify (WR-VER) commands executed is also of interest as they are essentially double (WRITE, then READ) data transfer commands which require more device and channel time.

The general fraction of utilization for each logical channel gives an indication of the degree of simultaneity of access to the subsystem. If only N of the configured logical channels have nonzero counts, then there were never more than N accesses being performed simultaneously by the

subsystem. The proportional relationships among the counts of accesses made over each of the logical channels are quantitative indications of the frequency of occurrence of specific levels of simultaneity. As an example, if we look at figure 7-2, we see that only 4487 connects out a total of 107,273 connects went to Channel 9, IOM 1. This means that only 4487 times during the measuring period were all four MSU450 disk channels being utilized simultaneously. In this example, channel queuing (i.e., shortage of channel power) would not appear to be a problem. This is not to infer that device queuing is not a problem, just that channel queuing does not appear to be a problem. If the number of accesses to the lowest priority channel is a larger percentage of the total accesses, then channel queuing needs to be examined. Queuing for devices and/or channels can be analyzed by running the Channel Monitor Data Reduction Program (see section 8).

7.5.3 System Traces Captured by Monitor Report (File 42). This report contains the number of occurrences of each specific trace type record on the data collector tape processed by the MSMDRP (figure 7-3). This report provides little, if any, information required by the user for his analysis. This report is always generated and cannot be turned off.

7.5.4 Channel Status Changes Report (File 29). This report lists the initial status for all tape and disk channels configured to the system (figure 7-4). If, during the course of the monitoring session, a given channel or IOM was dropped or added to the system (dynamic reconfiguration) a new report will be produced indicating the activation of deactivation changes and the time that the change occurred. Finally, this report will indicate whether the SSA cache option and FMS cache option are active, and if so, will indicate their initial status and any changes that occur to that status. If a given option is not active, a zero will be reported for each of the values. This report is always generated and cannot be turned off.

7.5.5 Physical Device, Device ID Correlation Table (File 42). Each mass storage device configured in the system is listed with a unique device ID. A typical report is presented in figure 7-5. This unique device is needed since different devices can have the same device number on the Honeywell 6000. (See Device ID 1, Device ID 7, and Device ID 18 of figure 7-5). These unique numbers are referenced in several reports produced by the MSMDRP. This report is always generated and cannot be turned off.

7.5.6 Device Space Utilization Report (File 42). The device space utilization histogram report is produced for every device on the mass storage subsystem and shows the distribution of access to the device space. Figure 7-6 is an example. It should be noted that the name of the device is also given. This example presents all connects made to the device with the name RF5. If an exchange took place and the RF5 disk pack was moved from 0-08-05 to 0-08-01 the data reduction program will account for that exchange and any connects that are made to 0-08-01 will be

680-764). This is not necessarily bad, but if "interlaced" accessing was between these two areas, many seeks of about 700 cylinders would result. If, on the other hand, accessing to one area was completed before accessing to another began, there would be no large number of movement seeks. In this case, the example in figure 7-7 shows 18 percent of the seeks to be across a distance of 714-764 cylinders. This represents a situation where the particular files and jobs may need to be identified so that methods for reducing the number of movement seeks may be found and implemented for performance improvement. Further confirmation of this problem could be found by analyzing the Head Movement Efficiency Report (see subsection 7.5.8 and figure 7-8). If a problem exists then the connects/arm movement column for this particular device should approach a value of one. This figure indicates how many connects are issued between each movement of the arm. Therefore, even though we may have long seeks occurring on the device, if a large number of connects are being processed between these seeks, this would tend to lessen the impact of the long seeks.

For the Device Space Utilization Report and Device Seek Movement Report, an entry is made only for multi-command connects (see subsection 7.3) such as a seek/read or seek/write. If the first command of an IO connect is not a seek, or pre-seek, then an entry will not be made to this set of histograms. For this reason, the number of connects reported in these reports, for a given device, may be somewhat lower than that reported in the Proportionate Device Utilization Histogram, described in subsection 7.5.20. In addition to not recording non-multicommands such as controller commands and reset status commands, there are also a significant number of multicommands that are issued by the system for which the system does not generate a "valid" seek address in the "normal" manner. These connects will not be reported in the Space Utilization or Seek Movement histograms, but will be reported in the Proportionate Device Utilization Histogram. Research is currently underway to determine under what conditions these "nonvalid" seek address I/O requests are generated and whether there is any procedure by which the MSM could determine the correct seek address (see subsection 7.3). This software release has a code included to correct this problem. Therefore, no occurrences of this condition should be reported in any of the MSM output.

7.5.8 Head Movement Efficiency Report (File 42). This report displays how many connects are issued per arm movement of the device. Figure 7-8 is an example. The first three columns give the IOM, Channel, and Device number of the device. This is followed by the number of connects issued to that device and the number of times any arm movement was required (size of the seek is not considered). The final column indicates the ratio of connects to arm movements. The larger this ratio is, the more efficient is the device (i.e., the larger is the number of connects being handled between each arm movement of the device). Following the breakdown of arm movement by individual device, a summary is presented for arm movement within each individual mass storage subsystem. This is followed by three lines of output summarizing the overall efficiency of the entire disk subsystem. The first line presents the total number of connects issued, the second

MSM HEAD MOVEMENT EFFICIENCY REPORT FOR SYSTEM NMCC ON 81-12-07

IOM	PUB	DEVICE	CONNECTS	ARM MOVES	CONNECTS/ARM MOVEMENT
0	08	01	34848	28491	1.223
0	08	02	21479	8673	2.477
0	08	03	30030	18410	1.631
0	08	04	31128	19449	1.600
0	08	05	0	1	0.
0	08	06	220	1	220.000
0	12	01	6449	3138	2.055
0	12	02	2520	86	29.302
0	12	03	2048	549	3.730
0	12	04	3303	562	5.877
0	12	05	4818	1887	2.553
0	12	06	2929	754	3.885
0	12	07	220	1	220.000
0	12	08	4824	1479	3.262
0	12	09	9145	3303	2.769
0	12	10	3249	690	4.709
0	12	11	2285	754	3.031
0	16	01	0	1	0.
0	16	02	0	1	0.
0	16	03	12	1	12.000
0	16	04	3754	168	22.345
0	16	05	260	12	12.667
0	16	06	220	1	220.000
0	16	07	220	1	220.000

DEVICE TYPE	CONNECTS	ARM MOVES	CONNECTS/ARM MOVEMENT
.DS181	4466	185	24.141
.DS191	41790	13203	3.165
.DS450	117705	75025	1.569

TOTAL MASS STORAGE CONNECTS	163961
TOTAL ARM MOVEMENTS	88413
HEAD MOVEMENT EFFICIENCY	1.854

Figure 7-8. Head Movement Efficiency Report

to read that file within the host system. Similarly, FTS cannot write a file on the host system any faster than it is receiving data from the network. The actual catalog/file string being transferred can be determined by obtaining the CAT/File String Report (see subsection 7.5.13). The two reports can be correlated based on time and file code. It should be noted that all FTS Catalog File Strings are separated from the remaining Catalog File Strings and outputted on a separate page of the CAT File String Report. In the FTS File Access Report, the time of day is printed in HHMMSS.SS format. This report will automatically be produced and cannot be disabled. Furthermore, if any two consecutive reads or writes to a given file take more than 30 seconds, a warning message will be produced on the Special Processing Message page. This warning message states:

*** Special FTS Message - FTS took xx seconds between consecutive IOS to the same file. TOD was .HHMMSSSS E 06

There appears to be a problem with the current version of this report and research is being conducted to generate a solution. In the current software, it is possible for the "Size-LL" column to report that a file is 50LL long and the "Trans-LL" column to report that FTS transferred 75LL. It would appear to be impossible for FTS to read/write more data than currently indicated to exist on the file. A fix will be released immediately upon testing and verification. In a majority of cases, however, the data being reported is accurate.

7.5.26 TSS Swap File Usage Over Time Report (File 42). This report is obtained whenever the user selects the Connects Per Minute Report (see subsection 7.5.24). The time quantum of the report is controlled by manipulating the time quantum control of the Connect Per Minute Report. This report will indicate the rate of TSS swapping that is occurring and the swap files being used. It will aid the user in determining if TSS swapping is a cause of bad TSS response and if the user should add additional swap files. If a period of bad TSS response has been observed or reported, this report can be used to determine if the rate of TSS swapping is significantly higher during this time period. If a correlation if found, then a possible explanation of the bad TSS response would be the subsystem swapping being performed by TSS. Figure 7-24.2 shows a sample of this report. If multiple copies of Timesharing are present, all swap activity going to #S, #T, etc., will be reported under the individual file, irregardless of which copy of TSS is responsible for the I/O activity.

7.5.27 Device Seek Movement Summary Report (File 29). It is possible for the user to turn off all histograms (see subsection 7.6.19), but still receive a report summarizing the seek movement activity to each device. This report is merely the last-line information that would have been reported on the individual histograms, had the histograms been obtained. Figure 7-24.3 is a sample of this report. In order to obtain this report, the user should refer to the input option LIMITS in subsection 7.6.19.

7.5.28 Special Processing Messages. During the course of processing, several special processing messages may be generated by the MSMDRP. Most of these are for information purposes only and can be ignored by the analyst. Following is a list and brief explanation of the most common messages. These messages will most normally occur immediately in front of the System Configuration and Channel Usage Report.

- MONITOR MUM WAS ACTIVE . . . .
  This message is produced for each monitor that was active during the monitoring session.

- MSM DATA REDUCED FROM CHANNEL MONITOR . . .
  The MSM was not active during the monitoring session but the Channel Monitor was active. Sufficient information is collected so that all reports from the MSMDRP can be generated with the exception of the SSA cache portion of the Individual Monitor Activity Report (see subsection 7.5.10).

- RUN BEING TERMINATED. DATA FOR MONITOR . . .
  Neither the MSM or CM were active and, therefore, no reports can be produced.

- PROCESSOR # N IS (AVAILABLE/RELEASED) AT (TIME)
  This message will indicate the assignment or releasing of

- SPECIAL FTS MESSAGE - FTS TOOK . . .
  The message is explained in subsection 7.5.25.

- WARNING WARNING SYSTEM INTERCOM IO . . .
  Refer to subsection 7.5.1

- WARNING WARNING I/O QUEUE TABLE . . .
  Refer to subsection 7.5.15

System File Use Summary Report discussed in subsection 7.5.9. This option is specified with a set of data cards. The first data card contains the word FILDEF. The second data card contains the number of system files to be described on the following cards. The following cards each contain a single pair of data points separated by at least one blank. The first data point is the system file number and the second data point is the desired system file name.

The standard output of the System File Use Summary Report is to label each system file as System File 1, System File 2, etc., corresponding to GCOS-HI-USE, GCOS-LO-USE, etc. In order to know the correct order of the file names, the user should check the $ FILES section of the startup deck. The order of the files in the $ FILES section of the startup deck is the order they are referenced in the report.

7.6.5 End Card (Action Code END). This card must be present at all times and must be the last data card supplied. It consists of the word END entered on the card.

7.6.6 Produce the SSA Module Usage Report by Job (Action Code MODULE). This option allows the user to produce the SSA Module Usage Report. This report will list every SSA module used by every job that was run during the monitoring session. See subsection 7.5.11 for details concerning this report. This report is off by default and cannot be turned on by using the ON option. This report can be activated only by entering MODULE on the data card.

7.6.7 Record Limitation by Connects (Action Code NCONN). This option allows a user to process only a specific number of connects. This option is especially useful if the tape contains an error on it and cannot be completely processed. Using this option, the user can process the tape or tapes up to the point where the tape error exists. This option requires two data cards. The first data card contains the word NCONN with the second card containing the number of connects to be processed.

7.6.8 Record Limitation by Records (Action Code NREC). This option allows a user to process only a specific number of tape records. This option is especially useful if the tape contains an error on it and cannot be completely processed. Using this option, the user can process the tape or tapes up to the point where the tape error exists. This option requires two data cards. The first data card contains the word NREC with the second card containing the number of tape records to be processed.

7.6.9 Turn a Report Off (Action Code OFF). This option allows a user to turn a report off that is on by default. In MSMDRP, all reports are on except report numbers 12, 16, 18 and 20 (see table 7-1). Only those reports in table 7-1 that have a name in parentheses () can be turned off with this option. Two data cards are required to use this option. The first card contains the word OFF and the second card contains the name of the report as displayed in the parentheses () in table 7-1.

7.6.10 Turn a Report On (Action Code ON). This option allows a user to turn a report on that is off by default. In MSMDRP, all reports are on except report numbers 12, 16, 18 and 20 (see table 7-1). Only those reports in table 7-1 that have a name in parentheses () can be turned on with this option (#9,10,12,15,16,17,18,20). Two data cards are required to use this option. The first card contains the word ON and the second card contains the name of the report as displayed in the parentheses () in table 7-1.

7.6.11 Produce Connect Summary Report by Userid/SNUMB (Action Code PROJ). This option allows the user to specify up to a total of 40 USERIDs and SNUMBs for which he wants the Connect Summary Report by Userid/SNUMB produced. The number of SNUMBs requested cannot exceed 10. In addition, since the File Code Summary Report can result in a large amount of output, the user may want to see the File Code Summary Report only for a prespecified set of jobs or USERIDs. For example, the user can request 35 different USERIDs and 5 SNUMBs or 40 different USERIDs and 0 SNUMBs or 30 different USERIDs and 10 SNUMBs or 3 different USERIDs and 6 SNUMBs, etc. The format for this option is shown in figure 7-26. If values of zero are desired, they must be punched on the card. A blank is not equivalent to a zero. In addition to producing a limited File Code Summary Report, a Connect Summary Report is also produced. This summary report will indicate for each requested USERID or SNUMB the number of connects made by the job or USERID. If a requested SNUMB also has a requested USERID, the number of connects issued by that job will be reported twice in the summary report. Refer to subsection 7.5.14 for a description of the report to be produced with this option.

7.6.12 Reduce WW6.4 Data or Process MSMDRP on a WW6.4 System (Action Code RN). This option requires two cards. The first card has the letters RN and the second card one of the following numbers:

1 - WW6.4/2H system processing WW6.4/2H data
2 - WW6.4/2H system processing WW7.2/4JS data
3 - WW7.2/4JS system processing WW6.4/2H data

The default is a WW7.2/4JS system with WW7.2/4JS data.

7.6.13 Set a Timespan of Measurement (Action Code TIME). The timespan of data collection can cover many hours of which only a few may be of interest. This option allows a user to specify the timespan (or spans) to displayed in all reports. For example, the user may specify that he wants to collect data from 0500 to 2200 and wants to display data only from 0900 to 1700 in all reports.

If the entire reduction will have a set timespan, the name "TOTAL" is used. Histogram reports cannot be individually timespanned. All timespans of "other" reports will be bounded by the overall report timespan, if one will be used. Up to five timespans for each report type may be specified,

```
$ XBAR     IOM-1,PUB-14,IOM-0,PUB-14
           IOM-2,PUB-14,IOM-2,PUB-13,
           IOM-0,PUB-13,IOM-1,PUB-13
```

MPC Cards

```
$ MPC-0    PSI-2,IOM-0,PUB-10,PSI-1,IOM-1,PUB-10,
           PSI-3,IOM-2,PUB-10,PSI-3,IOM-2,PUB-11,
           PSI-1,IOM-1,PUB-11,PSI-2,IOM-0,PUB-11

$ MPC-2    PSI-0,IOM-1,PUB-14,PSI-2,IOM-0,PUB-14
           PSI-1,IOM-2,PUB-14,PSI-1,IOM-2,PUB-13
           PSI-0,IOM-0,PUB-13,PSI-2,IOM-1,PUB-13
```

Chart

IOM/Channel	MPC/PSIA	IOM/Channel	MPC/PSIA
0-10	0-2	1-14	2-0
1-10	0-1	0-14	2-2
2-10	0-3 *	2-14	2-1
2-11	0-3	2-13	1-1 **
1-11	0-1	0-13	1-0
0-11	0-2	1-13	1-2

* problem 1
** problem 2

The problems described by the above procedures could be solved by redesigning the crossbar cards in the following manner:

```
$ XBAR     IOM-0,PUB-10,IOM-1,PUB-10,
           IOM-2,PUB-10,IOM-0,PUB-11,
           IOM-1,PUB-11,IOM-2,PUB-11

$ XBAR     IOM-1,PUB-14,IOM-0,PUB-14,
           IOM-2,PUB-14,IOM-1,PUB-13,
           IOM-0,PUB-13,IOM-2,PUB-13
```

If the I/O request cannot be granted, because either the channel or device being requested is currently busy, the request will be queued. This request will only be serviced when both a channel and device are free. When queuing occurs for a channel, GCOS will indicate the request queued over the primary channel. A primary channel is that channel which appears first on the $XBAR card, for a given string of devices. Therefore, all channel queue histograms are presented only for primary channels. However, a queue on the primary channel actually means that all channels, both physical and logical, connected to the desired device were busy. When the request is finally granted, a trace type 7 is issued.

A table is used to hold the device number, channel number, IOM number, I/O queue entry address, and the time the T22 trace event occurred. With the occurrence of each T22 event, the table entry is filled to mark the linking of the I/O requests. At this time, the required computations for determining the channel and device queue length are made. Channel queue histograms are produced for both tape and mass store devices, while device queue histograms are produced only for mass storage devices. The channel and device queue time also begins at this point and will be updated with the occurrence of the trace 7 event for this I/O request.

With the eventual occurrence of the trace 7 event for the I/O request, several updates are required to the common tables. The I/O queue time data are generated for the channel and device and collected for the appropriate histograms. It should be noted that it is possible for a device to show no queuing, but yet will display I/O queue time in its queue time histogram. The reason for this is that the queue time histogram is reporting the time difference between a T7 trace and a T22 trace. The T7 trace will not be issued until the actual I/O is initiated (i.e., a logical channel becomes available). Even though a logical channel might be available, several milliseconds might pass before a physical channel becomes available and the T7 trace is generated. Even if a physical channel is available, upon the occurrence of a T22 trace, several milliseconds might pass before the system generates the T7 event. This is especially true on a very busy system. A connect queue entry is now filled with data to be used for the I/O service time histograms. This connect queue holds the IOM, channel, device number, and the time of the trace 7 event. The channel and devices status table entries are also marked busy at this point. As a confidence test, the channel status is sensed at the start of processing for each trace 7 event for a nonbusy status. If it is busy, a lost interrupt is considered to have occurred since it is impossible for a connect to be issued to a busy device or channel. Device access histogram data and an IOM command execution count are also generated at trace 7 event time.

The next logical event for the I/O process is the termination interrupt originated by the IOM at the I/O data transfer completion. The signal for this event is transmitted by the IOM to the processor through the SCU as a request for the processor to service the I/O completion. The type 4 trace event contains the IOM number and channel for I/O termination. These data are used to determine the I/O service time by finding the time difference of the connect event and the terminate event. The time difference is collected and displayed in histogram form for each mass store and tape channel as well as for all mass store devices. The channel and device queue length are also adjusted at this point to reflect the absence of a queue being serviced for this channel and device.

It must be noted that exceptions to the normal I/O process are to be expected and must be accounted for in the reduction program. All the exceptions encountered so far have been diagnosed and coding in the program will allow for exceptions. Some of the exceptions include the following:

```
                 DISTRIBUTION COLLECTED ON SYSTEM NMCC2 AT 11:44:41 ON 80-10-06

                              I-O QUEUE TIME-MS FOR IOM-0,PUB-12

INDIV.   CUMUL.    CUMUL.    INDIV.    QUEUE                  PERCENT OF OCCURRENCE                  REPORT
NUMBER   NUMBER    PRC       PRC       TIME     00   10   20   30   40   50   60   70   80   90   100      7
                                                I....I....I....I....I....I....I....I....I....I....I
 9045     9045     100.000   100.000   2.000    IXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

 9045 ENTRIES TOTAL    AVERAGE =    0.    VARIANCE =    0.    STANDARD DEVIATION =    0.
```

Figure 8-18 (Part 2 of 2)

In determining the length of a channel queue, the following is considered:

- A channel queue of length 0 exists when there is at least one nonbusy, primary/logical channel.
- When all primary/logical channels become busy, the length of the channel queue is calculated by summing the length of all device queues on that channel.
- As an example, assume we had two channels configured with three devices. If device 1 became busy and 4 more requests were made for that device, we would have a device queue of 4 and a channel queue of 0. If during the same time, device 2 received 3 requests, we would generate a queue length 2 for that device but the channel queue would still remain at 0. In the situation described thus far, device contention, not a shortage of channels, is the problem. If we now assume that a connect was issued to device 3, we have now created a channel problem. There is no available channel for the I/O request. At this point, a channel queue of 7 (4 requests for device 1 + 2 requests for device 2 + 1 request for device 3) would be generated. Thus, we see that channel queues may increase in a nonsequential fashion.

8.5.10 Service Time Histograms (File 57). In all of the device histograms, it should be noted that the name of the device is also given. In figure 8-17, queuing statistics were presented for a device with the name DA4. If an exchange took place and the DA4 disk pack was moved from 0-12-04 to 0-12-07, the data reduction program will account for that exchange and any connects that are made to 0-12-07 will be reported on this histogram and not to the 0-12-07 histogram.

In the upper right-hand corner of the report, a report number is indicated. This report number is used only to distinguish one histogram from another and in no way indicates the device to which the report refers. In addition, report numbers may not appear sequentially and this in no way is indicative of a problem. All histogram reports are generated by default and may be turned off by using the LIMITS option (subsection 8.6.13).

Figure 8-19 shows the I/O service time histograms for each I/O channel and device. Each histogram is given in 2ms intervals. The I/O service time is defined as the time (in ms) from connect to the time that IOS processes the terminate interrupt for the I/O request. These histograms are generated for both mass store and tape channels, as well as all mass store devices. On the bottom line of this report, an indication is given as to the percent of total time that this device or channel was busy.

The three device-oriented histograms, just described, have entries placed in them for every connect issued to the device (not just multicommands such as seek-read or seek-write).

SECTION 9. COMMUNICATIONS ANALYSIS MONITOR DATA REDUCTION PROGRAM (CAMDRP).

9.1 Introduction

The Communications Analysis Monitor Data Reduction Program is a FORTRAN program that sequentially processes data the Communications Analysis Monitor collected and wrote on tape. CAMDRP produces a number of reports depicting the usage of terminals, the response being received by terminals and the various DAC subsystems, and a special analysis report on Time Sharing Response. Report descriptions are presented in subsection 9.5.

There are two inputs to the CAMDRP. The first is the data tape produced by the CAM in the General Monitor Collector. The second is a set of report option control cards used to alter the reports in some way other than the standard default. The various user input options and their formats are described in subsection 9.6. The actual reports produced by CMDRP are described in subsection 9.5.

9.2 Data Collection Methodology

The CAM in the General Monitor Collector processes a GMF generated trace type 14 and collects information to monitor the usage of the entire terminal and DAC subsystems. The information collected on the occurrence of the above trace enables the CAMDRP to identify the DAC Subsystem Activity, response time being received by both DAC subsystems and terminals, and the extent to which any terminal is being utilized. The method used for generating the CAM traces is described in subsection 5.2.6 and the formats for the CAM generated records used by the CAMDRP are described in subsection 5.4.7.

9.3 Analytical Methodology

All communications between the H6000 and an online user is controlled by the GCOS module .MDNET (.DNWW in W6.4). This module contains a series of buffers, called mailboxes, that are used to store data passing between the datanet and the H6000. Whenever either machine wants to communicate with the other, information is placed in a mailbox and an interrupt is generated. The Communications Analysis Monitor (CAM) is designed to examine the mailboxes each time they are changed and to generate a GMF trace type 14. The trace type 14 is used by CAMDRP to provide data transfer rates, machine response times and user think times. The data transfer rates are derived from the number of words transferred for each interaction. Machine response time can have multiple definitions. One definition is the amount of time from the transfer of the first character of data by the user (carriage return) to the first response back to the user from the

system. This definition is not precise in that as soon as GCOS recognizes it has received information from the datanet, a receipt acknowledgement is sent back to the datanet. This acknowledgement does not indicate any processing by GCOS; just receipt of the data.

A second definition of response time is the same start time (carriage return) but the stop time is when the user has received his last piece of data before being required to give another response. This definition also is not precise in that the system response is not complete until possibly a full screen of data has been transmitted. This definition also lumps GCOS and subsystem (TSS, TRAX) response together. However, it is felt that this method is a more realistic method of response time calculation, and is the method used by CAMDRP.

User think time is defined by CAM to be the amount of time from the start of data transmission to the user until the receipt of the first character of user response. This includes any datanet delay time (monitored by the datanet monitor) and any user wasted time (coffee break, phone call, etc.). However, this is the best definition available with the type of data captured by the CAM. Figure 9-1 presents a pictorial representation of these definitions.

9.4 Data Reduction Methods

The CAMDRP reads only the trace type 14 records and any special records. It ignores lost data records, which can cause loss of some logons and disconnects. The CAMDRP logs a user onto a subsystem only when "connect to slave" command is captured. This command gives the actual subsystem the user is connecting to (TSS, TRAX, etc.). If, when CAMDRP first begins processing, a user is found to already be logged onto the system and no "connect to slave" command has been found, the user is logged onto an "UNKNWN" subsystem. This is because the "connect to slave" command is the only time the actual subsystem name is known. However, for every terminal logged on to TSS, each time a response is generated, the USERID of the terminal user is collected. CAMDRP uses this information to log the user on to TSS.

If, during processing, a datanet is found to have crashed, all users connected to that datanet are disconnected by the CAMDRP and processed as an end terminal session. If a reduction time frame ends, all users are disconnected as if their terminal session ended, and all reports are printed.

9.5 CAMDRP Output

The CAMDRP produces a header page and either a 355 Mailbox Report or Statistical Summary Reports, Terminal Session Reports, and requested histograms. The following subsections will describe all the reports produced by the CAMDRP.

- Average number of outputs - Average number of system responses per session (number of outputs/number of sessions collected

- Flag - Logical flags indicating any unusual conditions in this category. Flag explanations appear on the printout.

The user should note that summaries for the same batch device with different flags are not mixed. Thus, for example, there may be several summaries for RLP 3000 with the majority of normal sessions reflected in one summary and exceptions in the others. The exceptions imply conditions such as GMC starting its collection in the middle of some terminal session for which the session length cannot be determined.

9.5.3.2 DAC Subsystem Summary Report. The DAC Subsystem Summary Report (figure 9-5) summarizes the characteristics of users of DAC subsystems such as TSS and TPS. The heading of each report gives the subsystem utilized. The categories summarized are the same as those categories discussed in subsection 9.5.3.1.

Invariably, a number of the subsystems summarized are bogus due to user typing errors. For example, the following misspellings of TSS may appear: 'YSS', and 'TS'. These reports do not imply that these subsystems exist, only that some user attempted to log-on to a system with that name. Some users logged onto the system prior to the CAM starting will be considered as logged onto subsystem UNKNWN (see subsection 9.4).

9.5.3.3 Remote Batch Device Summary Report. The Remote Batch Device Summary Report profiles the devices using remote batch mode communication protocols such as remote line printers (RLP300) and remote computers (RCT) (figure 9-6).

For each device, the following values are reported:

- Number of jobs collected - Total number of distinct jobs reflected in this report.

- Number of input jobs - That part of the total number of jobs which are input jobs.

- Number of output jobs - That part of the total number of jobs which are output jobs. Certain RCT (H716) reports contain jobs that may be counted as both input and output; more detailed examination of the raw data is required to verify this circumstance.

- Job length (sec) - Time from the first to the last data transfer for that job.

DAC SUBSYSTEM SUMMARY FOR NMCC2 ON 122181

	TPE		TSS		UNKNWN	
	MEAN	STD DEV	MEAN	STD DEV	MEAN	STD DEV
# SESSIONS COLLECTED	1.		27.		4.	
SESSION LENGTH (SEC)	104.0	0.	1345.2	1493.2	1003.8	1612.4
INPUT LENGTH (CHAR)	8.0	7.3	23.3	54.5	0.	0.
OUTPUT LENGTH (CHAR)	35.5	62.1	89.5	222.0	438.1	69.6
# OUTPUTS PER OUTPUT GROUP	1.0	0.2	1.0	0.1	610.8	979.0
USER THINK TIME (SEC)	4.6	4.0	18.3	36.0	0.	0.
MACHINE RESPONSE TIME (SEC)	4.0	9.3	3.3	17.9	0.	0.
OUTPUT TIME (SEC)	0.	0.	0.0	0.2	1.7	1.3
CHARACTER RATE (CHAR/SEC)	16.0	0.	11.8	12.0	281.5	325.0
# INPUTS	12.0		934.0		0.	
AVG # INPUTS	12.0		32.6		0.	
# OUTPUTS	42.0		2819.0		2443.0	
AVG # OUTPUTS	42.0		104.4		610.8	

Figure 9-5. DAC Subsystem Summary Report

```
              DISTRIBUTION COLLECTED ON SYSTEM NMCC2 AT 11:54:15 ON 81-12-21

                         SESSION LENGTHS FOR SUBSYSTEM      TSS

INDIV.   CUMUL.   CUMUL.   INDIV.                      PERCENT OF OCCURRENCE              REPORT
NUMBER   NUMBER    PRC      PRC    MINUTE    00   05   10   15   20   25   30   35   40   45   50   3
                                              I....I....I....I....I....I....I....I....I....I....I
  15       15     10.60    10.60    0-   0    Ixxxxxxxxxxx
  43       58     40.90    30.30    0-   5    Ixxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
  14       72     50.80     9.90    6-  10    Ixxxxxxxxxx
  16       88     62.10    11.30   11-  15    Ixxxxxxxxxxx
   8       96     67.70     5.60   16-  20    Ixxxxxx
  14      110     77.60     9.90   21-  25    Ixxxxxxxxxx
   .        .       .        .      .    .    .
   .        .       .        .      .    .    .
   .        .       .        .      .    .    .

142 ENTRIES TOTAL     AVERAGE =    17.33099    VARIANCE =    433.799    STANDARD DEVIATION =    20.828
```

Figure 9-11. Session Length Report

experiences a response time greater than or equal to the requested limit. The information printed includes Terminal ID, subsystem name, response time in seconds, and time of day. Refer to figure 9-12.

9.5.7 User Think Time Limit Report. This report is produced only if the user requests it with the THINK input option (subsection 9.6.7). This report will print out a line of information every time a terminal experiences a response time greater than or equal to the requested limit. The information printed includes Terminal ID, subsystem name, think time in seconds, and time of day. Refer to figure 9-12.

9.5.8 Terminal Session and High Terminal Usage Reports. The Terminal Session Report (figure 9-13) is produced whenever the Statistical Summary Reports are requested. The report gives an account of every session that occurs during the monitoring session. Every time a user logs off or is logged off due to a DN355 abort, TCALL, or monitor termination, an entry into this report is produced. The report gives the Log On Time, Log Off Time, Terminal ID, Subsystem, Session Length, Response Time, # Inputs, # Outputs. If a terminal was logged onto a subsystem when CAM started, then there is no immediate way for CAM to determine the subsystem being used by the terminal. In this case, the CAM data record will be checked to see if a USERID exists for the terminal. If one does exist, it means the terminal is logged on to TSS and the log on name is changed from UNKNWN to TSS. If there is no USERID for this terminal in the record, the subsystem name is set to UNKNWN. This occurs for the WIN lines and any user logged on to VIDEO when the monitor is started. If a user JDACS to a new subsystem, CAMDRP will disconnect the current line, calculate all statistics and reconnect the line to the new subsystem. The Session Length is given in seconds. The Response Time is given in seconds and is the average response time over the session. The # Inputs is the number of input requests sent by the user. The # Outputs is the number of output response groups sent to the user. This report can help pinpoint excessive response times. It can also be used to determine if a terminal is logged onto the system and is not being used (low inputs, high or low outputs, long session length).

The High Terminal Usage Report is included as part of the Terminal Session Report and provides a list of terminals that have been logged on for a specified percent (default 75%) of the session. This will list terminals by ID and type, give the percent of time the terminal was logged on, the number of sessions during this time, the number of inputs and the number of outputs from the terminal. (See figure 9-14.)

9.5.9 Opcode Count Report. This report (figure 9-15) is produced whenever the System Summary Reports are produced. This report gives a listing of all the opcodes that were transmitted between the H6000 and the DN355, and a count of how many of each opcode there were. This report is of interest mainly when the following opcodes appear:

OPCODE	DESCRIPTION
11	Output not available
16	Reject request (temporary)
17	Reject request (permanent)
20	Terminal rejected
110	Backspace output

These opcodes indicate a delay in data transmission or a communications problem. If these opcodes show up consistently, and in significant numbers, a detailed analysis should be conducted.

9.5.10 Response Time Report. This report is produced whenever the user sets the interval time using the input option RATE (subsection 9.6.11) or SNUMB (subsection 9.6.12). The report shows, for each interval, the time of day, the response time in general (i.e., averaged over all DAC subsystems), the response time for the requested subsystems, and the number of opcode rejects, RSVPs and RJMs. (See figure 9-16). The column headings are as follows:

TOD - Time Of Day

RESP - average response time over the time period

I/R - average response time of those responses considered acceptable (see sections 9.5.6 and 9.6.6)

#I - number of responses in the acceptable range

#0 - number of responses in the unacceptable range. This number is important in validating the figure in the RESP columns. One extremely bad response can cause a skewed average response.

USER - average number of users on this subsystem during the time frame

OPREJT - number of Opcode Reject Temporary commands received during the period

OPREJP - number of Opcode Reject Permanent commands received during the period

RJM - number of Reject Message commands received during the period

RSVP - number of Resend requests received during the period

NOTE: If TSS is one of the SNUMBs requested, all TS SNUMBs (TS1-TS4) will be represented under TSS.

9.5.11 Error Messages. The CAMDRP can produce multiple error messages relating to the data type. Most of these messages are actually warning messages, which the CAMDRP will try to recover from and will continue to process.

The most prevalant error message is the warning message "TERMINAL ID NOT FOUND." This message usually occurs when a terminal has been logged onto the system prior to the CAM starting to collect its data. When the CAMDRP tries to find a particular user who is receiving or transmitting data in its tables, that user will not be found since the CAMDRP did not find any log-on record for him. The user is logged onto the system and the CAMDRP continues processing.

The main reason for the CAMDRP to abnormally stop processing is the error message "NO MORE ROOM IN INDEX ARRAY." This means that an internal array has been filled. This is usually the terminal ID array. The parameter SMAX must be increased to enlarge the required arrays. The current size of SMAX is 100. This can be exceeded if there are a large number of users on the system when the CAM is started. If a terminal is logged on when the CAM is started, the terminal is logged on to subsystem UNKNWN. When this terminal disconnects and reconnects, it is now logged on to a valid subsystem and a different entry is made as this is now a complete terminal session. All complete terminal sessions are collected in one entry, but any unusual session required a separate entry. All other messages produced will be self-explanatory. If they do not indicate a severe error, the words "For Information only" will appear with the message.

9.5.12 H6000-DN355 Reject Report. This report displays all the terminal IDs that have had some type of error opcode from or to the DN355. These opcodes are RJM, RSVP, ECHO, OPCRJT, OPCRJP (see figure 9-16.1).

9.5.13 Abort Report. This report indicates each time the DN355 aborts and is reinitialized. It also presents each time line IDs 01,02 disconnect. These disconnects indicate a WIN problem since WIN has lost its network connection (see figure 9-16.2).

9.5.14 TS1 Initial Parameter Report. This report indicates the initial preset values for TS1. These values are SIZE parameters, LIMIT parameters, SWAP FILES parameters and a list of all ALLOCATED DEVICES per file code. This report is produced once, so if any parameters are changed during the run (such as TS1 max size), the change is not reported. See figure 9-16.3 for a sample of this report.

9.5.15 Mailbox Busy Report. This report is printed out each time a Response Time Report line is printed. This report indicates the running total of special interrupts that have occurred during the time frame and the average number of unanswered interrupts, requests waiting mailboxes and lines waiting mailboxes, and the maximum number of unanswered interrupts and requests waiting for a mailbox recorded during the time interval. A line is produced for each datanet (see figure 9-16.4).

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RESPONSE TIME REPORT FOR NMCC ON 030382

TOD	RESP	SYSTEM I/R	# I	# O	USER	RESP	TSS I/R	# I	# O	USER	RESP	FTS I/R	# I . . .	OPREJT	OPREJP	RJM	RRSVP
12:38:01	0	0	659	7	13 I	1	1	8	0	1 I							
12:43:01	0	0	835	10	15 I	2	2	2	0	2 I	0	0	3 . . .	1	0	0	0
12:48:01	0	0	849	6	18 I	2	1	43	1	4 I	6	6	1 . . .				
12:53:01	2	0	604	6	18 I	9	2	32	2	4 I			. . .				
12:58:02	2	0	469	7	18 I	19	3	14	1	4 I			. . .				
13:03:02	2	0	247	4	18 I	39	1	5	2	4 I			. . .	1	0	0	0
13:13:03	1	0	976	6	17 I	7	1	33	1	4 I			. . .	7	0	4	0

Figure 9-16. Response Time Report

```
                         TS1 INITIAL PARAMETER REPORT

                               SIZE PARAMETERS

         INITIAL TS1 MAX SIZE      180K        SIZE GROWTH    FACTOR              20K
         MINIMUM TS1     SIZE       60K        SIZE REDUCTION FACTOR              20K
MAX TIME ALLOWED FOR SIZE CHANGES   60SECS     MAX TIME ALLOWED BETWEEN GMORE REQUESTS   10SECS
              MEMORY SIZE REDUCTION TIME INTERVAL        120SEC

                               LIMIT PARAMETERS

         MAX NUMBER OF TERMINALS      90       MAX NUMBER CONCURRENT DRL TASKS      4
         LARGE SUBSYSTEM SIZE FENCE   20K      LARGE SUBSYSTEM WAIT TIME PENALTY    8
         NUMBER OF 32MS TIME QUANTUMS  8       FREQUENCY OF PRIORITY B DISPATCHING  1
              RECONNECTION TIME LIMIT            300SEC

                                  SWAP FILES

         NUMBER OF SWAP FILES IN USE   2       SWAP FILES IN USE:     #S     #T
         MIN SWAP FILE SIZE        1200LLINKS  MIN SWAP FILE GROWTH SIZE          300LLINKS

                               ALLOCATED DEVICES

              FILE                             DEVICE/FILE NAME
               #D                                   DQ1
               #P
               #Q
               .D                                   .D
               SS
               #S
               #T
```

Figure 9-16.3. TS1 Initial Parameter Report

MAILBOX BUSY REPORT FOR NMCC2 ON 062582

TIME OF DAY	DN	SPECIAL INTERRUPTS	UNANSWERED INTERRUPTS	REQUESTS WAIT MBX	MAX UNANSWERED	MAX WAITING	LINES FOUND WAITING MBX
11:10:37	0	22	0	0	0	0	0
11:10:37	1	13	0	0	0	0	0
11:11:37	0	5525	0	0	0	0	0
11:11:37	1	239	0	0	0	0	0

Figure 9-16.4. Mailbox Busy Report

DISTRIBUTION

Addressee	
CCTC Codes	
C124 (Reference and Record Set)	3
C430	250
C751	30
DCA Code 308c	1
Defense Technical Information Center, Cameron Station, Alexandria, Virginia 22314	12
	296

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